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PAKISTAN'S EDIBLE OILSEEDS INDUSTRY

Prepared for the Pakistan Oilseed Development Board

by the Office of International Cooperation and Development, United States Department of Agriculture

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PART I

AN OILSEEDS STRATEGY FOR PAKISTAN

SUMMARY

OF

CONCLUSIONS AND RECOMMENDATIONS

Prepared by

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United States Department of Agriculture
Office of International Cooperation and Development

Under the Auspices of

The United States Agency for International Development

Islamabad, Pakistan

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PREFACE

The Office of International Cooperation and Development (OICD) of the U.S. Department of Agriculture, under an agreement with the Pakistan Mission of the U.S. Agency for International Development, has completed a study of the total oilseeds sector of Pakistan for the Government of Pakistan's Oilseeds Development Board. The study has involved seven technical teams and a total of 24 individual consultants. These technical teams addressed the following topics: Research; Production; Alternative Crops; Domestic Markets and Trade; Oilseed Storage, Processing, and Distribution; Poultry and Livestock Production and Marketing; and Policy and Organization.

This summary report is a synthesis of 30 separate reports written by the technical teams. It was prepared by the oilseeds consolidation team after assessing the findings and recommendations of the technical teams and reviewing the drastic changes in the world edible oils market since the technical reports were completed. It presents an action plan that is realistic and usable by decision makers in the Government and the private sector. The report deals specifically with oilseed pricing policy and organization, oilseed markets, edible oil imports, oilseed processing, oilseed production and research, and the utilization of oilseed meal for poultry and livestock.

The summary is divided into six parts. The first section offers a brief overview of the consolidation team's major conclusions and recommendations. Section II. reviews the current edible oils situation. Section III. assesses the availability of resources for edible oils production. Section IV. offers a comprehensive edible oils strategy, including a new marketing policy. Section V. analyzes the implications of one of the proposed new policy's major points, increased vegetable ghee prices. Finally, Section VI. describes long-term programs that the GOP should consider in conjunction with the policy recommendations.

I. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A. The Problem and the Potential

Vegetable oils are Pakistan's largest single food import. With consumer demand steadily increasing at seven percent a year, and with domestic production stagnant, the vegetable oil problem in Pakistan has reached crisis proportions. Unless bold action is taken now, by 1985 Pakistan will be faced with an edible oil import bill of $639 million, at current prices. The major conclusions of the oilseeds sector study are:

- That this crisis can be overcome by immediate and strong action on the part of the Government of Pakistan because the basic resources are available for the successful long-term development of a viable oilseeds industry and increasing self reliance in edible oil production;

- That, in both the short term and the long term, the prerequisite for a substantial and sustained increase in the production of oilseeds and edible oil in Pakistan is a free and competitive market which harnesses the energies of the private sector as the major engine of change; and

- That no major change in government organization is required, although the role of the Ghee Corporation should be altered.

B. Policy Actions Recommended

In order to reduce increasing dependence on costly imported oil, improve the efficiency of oil refining and oilseed crushing, and increase oilseed production, the following policy actions are recommended:

- Any private firm or government agency should be free to import oil.

- The importers should be required to sell oil to any refinery at fixed, uniform prices that are tied to the retail price of vegetable ghee.

- Any refinery should be free to import oil directly, buy from an importer, or buy from a domestic oilseed crusher.

- The retail price of vegetable ghee should be allowed to rise to the Indian border price, which currently is at least Rs 15 per kilogram.

- The current price support levels for domestic oilseed production should be maintained as a price security floor for farmers.

- All firms in the edible oil sector should be free to earn normal processing and marketing margins.

- The GOP should implement its policy of denationalization and deregulation in the edible oil processing sector and encourage new competition by private oilseed crushers and oil refiners.

C. Implications of Higher Vegetable Ghee Prices

The depressed real price of vegetable ghee is impeding the domestic production of edible oil. It must be increased before the proposed free market can operate effectively. A decision to increase the price of ghee to the Indian border price would be a bold and difficult decision, but the benefits to the nation would be great. Compared with maintaining the current price, an increase to Rs 15 now would result in:

- A six percent <u>decrease</u> in total edible vegetable oil consumption, but a 61 percent <u>increase</u> in liquid cooking oil consumption;

and, within three years,

- A 60 percent increase in domestic oil production;

- Annual foreign exchange savings of $392 million;

- 30,000 additional man-years of employment.

D. Government Programs

The recommended government programs generally need only to be refocused or strengthened. Their success is largely dependent upon a stronger free market system. If prices and market restrictions remain unchanged, these programs will continue to be ineffectual. Conversely, the gains of the free market strategy will be lost over time without the support of effective long-run government oilseeds programs. The key proposed programs are in the areas of:

- Crop Production and Research

- Animal and Poultry Feed

- Poultry

- Livestock

II. BACKGROUND

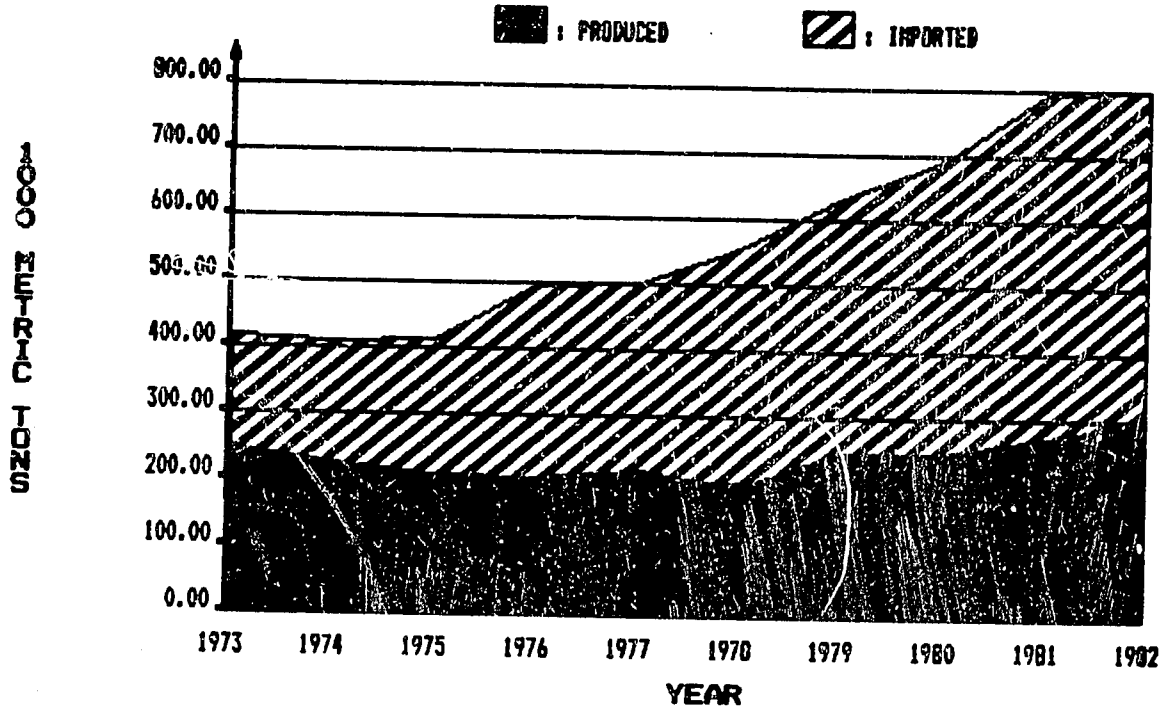
A. The Current Situation

The vegetable oil problem in Pakistan has assumed crisis proportions. Spurred by rising incomes and a declining real price for vegetable ghee (vanaspati), edible oil consumption has increased about seven percent per year during the past decade. Consumption of vegetable ghee and liquid cooking oil has risen from about 400,000 tons in 1973 to about 800,000 tons in 1982. (Figure 1.)

During this same period, domestic oil production has increased at an annual rate of two percent. The availability of edible oil from the major crops of cotton and rape seed has been erratic. Much of the slight increase in oil production has come from sesame and from non-traditional crops such as sunflowers and soybeans.

To overcome the growing gap between production and consumption, during the last decade, edible vegetable oil imports increased almost twofold to 500,000 tons in 1982. Foreign exchange costs increased from $31 million in 1973 to an estimated $224 million in 1982. During the past decade, Pakistan's imported edible oils cost about $1.5 billion.

Figure 1. Pakistan's Edible Vegetable Oil Consumption, 1973-1982



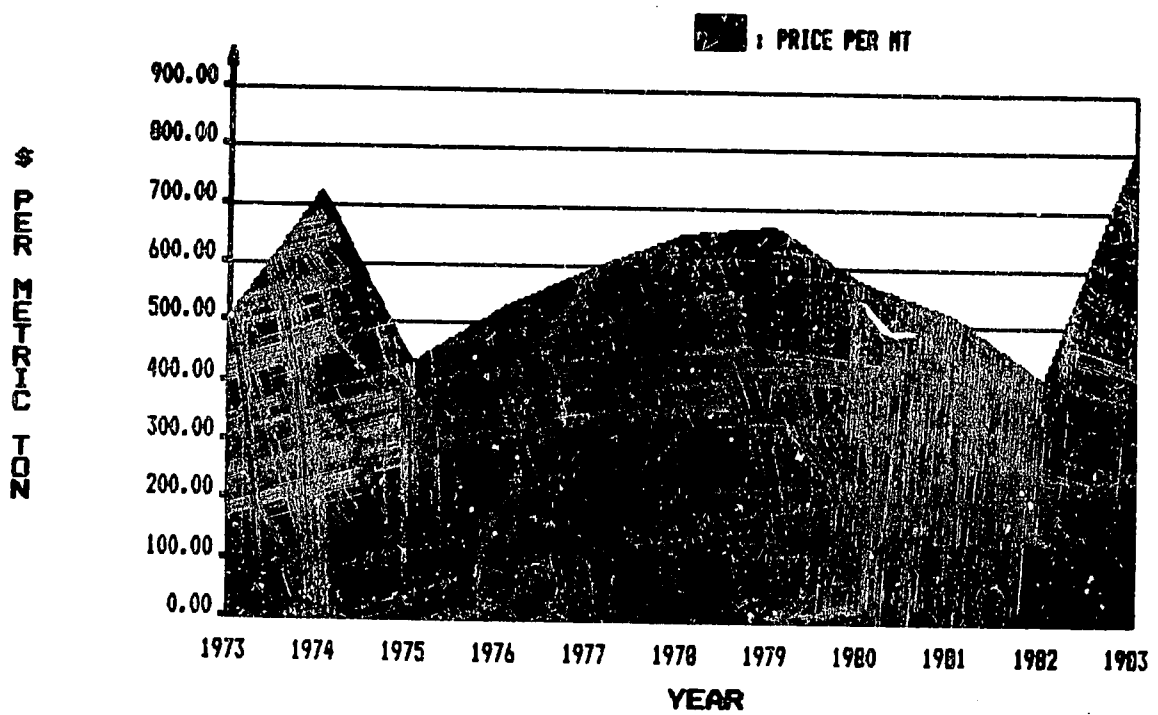
Source: USDA/OICD estimates.

The world edible oils market has become increasingly unstable during the last decade and Pakistan's balance of payments problem has been further aggravated by this trend. During the last six months, the average price of imported oil has almost doubled and may reach $800 per ton for 1983. (Figure 2.)

If the current edible oils policy does not undergo a fundamental reformulation, these trends will continue, or even accelerate, because:

- Consumption will continue to outpace production growth if the real price of ghee and cooking oil continues to decline.
- Domestic edible oil production will remain stagnant because of the adverse affects of price controls and government restrictions on private processing firms.
- The current program for traditional and non-traditional oilseeds is ineffective.
- International edible oil prices are unstable and the average price will increase over the long term.

Figure 2. Pakistan Average Imported Edible Oil Prices, 1973-1983



Source: IBRD and USDA/OICD estimates.

As a result, unless bold action is taken now, by 1985 Pakistan will be faced with an edible oil import bill of $639 million, even at current prices. Table 1. summarizes the past, present and future situations under these conditions.

Table 1. The Edible Oil Consumption-Production Gap

Period	Consumption ('000 MT)	Domestic Production ('000 MT)	Imports ('000 MT)	Foreign Exchange Cost ($ Million)
1973/74	414	244	170	63
1982/83	861	299	562	224
1985/86	1,175	323	852	639

Source: IBRD and OICD/USAID estimates, assuming current policies. Consumption includes vegetable ghee, liquid cooking oil, and a small amount of edible oil for industrial use.

B. Current Marketing Problems

Two specific marketing problems have created most of Pakistan's high edible oil import dependence: (1) edible oil price controls and (2) government domination of the oil processing industry. They have reduced necessary private sector incentives and contributed to sector-wide stagnation and inefficiency.

Edible Oils Price Controls

Price controls have kept vegetable ghee prices artificially low, compared to other staple foods. The retail price of vegetable ghee has been held constant since 1979/80. If the Government had allowed the price to rise with the consumer price index for food, the present price would be about Rs 14.7 per kg. In fact, real ghee prices have declined for over a decade. If the present price was inflation-adjusted for this period, the resulting price would be considerably higher than Rs 15.

Between 1978 and 1982, wholesale sugar prices increased 63 percent, and wheat increased 38 percent, while vegetable ghee increased only 7 percent. Since wholesale prices of most staple foods increased faster than vegetable ghee, farmers have found oilseeds less attractive than other crops.

During the last decade, both sugarcane and wheat farmgate prices generally followed wholesale price increases, leading to more than a 50 percent increase in production. Just as oilseed prices lagged behind wheat and sugar price changes, oilseed production also lagged far behind wheat and sugar production.

Price controls have also created a potentially dangerous relationship between the prices of vegetable oil in Pakistan and in India. The current retail price of vegetable ghee in India is at least Rs (Pakistan) 15 per kilogram, or about 40 percent higher than Pakistan's price of Rs 10.7 per kilogram. This disparity between the price of a major staple food in neighboring countries is ironic because Pakistani farmers have no price incentive to produce for the local market, which faces an enormous imported oil bill, but are not free to produce for the more lucrative Indian market. Oil smuggling from Pakistan to India will increase as the price gap between the two countries widens.

Government Domination of Processing

In addition to price controls, nationalization of edible oil refineries has limited private sector competition in the edible vegetable oil market. The Ghee Corporation of Pakistan (GCP) has near monopoly control of edible vegetable oil processing.

The GCP is currently a monopsony buyer of cottonseed oil. With insignificant amounts of other oils available, the private sector is effectively excluded from the domestic oil processing market. What remains is the government program for the procurement of nontraditional oilseeds. It is obviously not sending the right price signal to the farmers. The inescapable conclusion is that the oilseeds market is not functioning effectively and that farmers are heavily discounting the published prices for nontraditional oilseeds.

This conclusion is strongly supported by recent field surveys and market studies. There are repeated instances where farmers had been promised that their oilseed crop would be purchased and it has never been picked up. In other cases, delays in pick up or in payment are so prevalent that farmers are not willing to plant the crop in the following year.

The corporation is burdened by constraints which result in inefficient vegetable ghee production. GCP has unnessarily high labor costs. Also, its oilseed procurement program is understaffed and too unreliable for farmers to expect prompt crop lifting and payment.

The present pricing policy offers little incentive to shift procurement of crude oil away from expensive, imported oil, and toward relatively cheaper domestic oils. Thus, its procurement program for nontraditional oilseeds has not reduced dependence on imported oil.

III. AVAILABLE RESOURCES

A. A Linear Programming Model

The basic conclusion and recommendation of this study is that changes in policies related to pricing and marketing will result in large increments in the production of edible oil and other oilseed products. This is based in large part on the calculations of the profitability of oilseed production as demonstrated by a linear programming model. The recommendations for the necessary changes are based on the availability of key resources which are discussed in the following sections.

The Model Design

Farming interactions and farmer response are difficult to predict under ideal circumstances. In Pakistan this problem is compounded by the lack of accurate and timely data, particularly the farm level data which are critical to such an analysis. To help overcome this data constraint and to measure the extent to which price ceilings or other factors are barriers to increased oilseed production, a simple linear programming model was developed.

The OICD model was adapted from the linear programming model developed by the World Bank and WAPDA for analyzing the Indus River Valley Irrigation system. In assessing the edible oils sector, the OICD model served three principal purposes:

- Calculate the net return to farmers from alternative crops, using the present crude oil price of Rs 250 per maund as a base price.
- Determine seasonal competition among crops.
- Determine whether there are land or labor constraints to increased oilseed production.

Overall Results

The analysis shows that oilseeds are generally competitive with alternative crops and that in the Punjab and Sind returns from sunflower are exceeded only by sugarcane. In these calculations, yields for non-traditional oilseeds were set slightly higher than current average yields in order to reflect the stimulus of increased prices, but they were set well below actual yields that are currently being achieved by progressive farmers. Since the model cannot calculate returns from double cropping, a rotation of sunflower with another crop would clearly provide the highest annual return for a farmer in those two provinces, and other oilseed rotations such as soybeans and wheat, would be very profitable. (While not specifically calculated in the model, the results indicate that climatic conditions and land scarcity in

the Northwest Frontier dictate that its highest return alternative would be seed production for oilseeds and other crops.)

The model cannot predict the exact oilseed crop mix that would result from improved market performance, but sunflowers would have a prominent role because of their high oil production per hectare. It is estimated that cottonseed, currently the major source of domestic oil, would yield 82 kilograms per hectare. Sunflowers would yield 421 kilograms per hectare.

While there is some seasonal competition among crops, in overall terms it is not a constraint to increase oilseed production. Over the long run, however, higher oilseed prices would undoubtedly lead to stronger crop competition.

Finally, the model indicates that there are no major land or labor constraints to greatly increased oilseed production. Again, relatively higher oilseed prices would increase oilseed crop competition for inputs, but it would also produce a crop mix that is more nearly aligned with Pakistan's competitive position in world markets.

B. Arable Land

Expansion of the acreage of oilseeds into only part of the areas that are idle or poorly used at certain seasons of the year could produce enough edible oil to offset this year's imports. Among such areas would be:

- Dobari lands in the Sind and the Southern Punjab often lie idle between summer crops of rice.
- Cotton fallow areas where no crop is grown between summer crops of cotton.
- Riverine lands which are flooded during the summer but are dry during the winter.
- Dryland (barani) areas which are available in part for winter or summer oilseeds crops.
- Areas available for intercropping, e.g., fall planted sugar cane fields where short-season winter oilseed crops can produce a crop without adversely affecting slow developing cane.

Table 2. shows the idle or underutilized areas available and potential production for these lands, except for riverine lands. An estimated 3,000,000 hectares of other than riverine lands are available. If this area were fully used for oilseeds it could produce 595,000 tons of oil and 1.2 million tons of meal. The average assumed oil yield (203 kilograms per hectare) is based

on a broad mix of oilseed crops and is conservative. If those areas were planted in sunflowers, higher oil yields would be expected.

Table 2.

Areas Available for Oilseeds and Their Potential Production

Type of Land	Hectares ('000) Total	Hectares ('000) Area Readily Available	('000 MT) Oil	('000 MT) Meal
Dobari	1,900	570	130	296
Cotton-Fallow	2,210	663	159	371
Rainfed	6,000	1,500	262	488
Intercropped	400	200	14	26
TOTAL	10,510	2,933	595	1,181

Source: USDA/OICD estimates.

C. Idle Processing Capacity

About seven percent of Pakistan's oilseeds are crushed in traditional village kohlus which crush only rapeseed. The remainder are crushed in Lahore Expellers (82 percent) and solvent extraction plants (11 percent). The indigenous Lahore Expellers are low pressure mechanical screw presses that are remarkably efficient. While they extract much less of the available oil than a solvent plant, they cost about half as much to operate. There are 12 or 13 relatively modern solvent plants in Pakistan that could be made fully operational. As Table 3. shows, both expellers and solvent plants are underutilized. This is due to the seasonality of cottonseed, current low market prices and the shift of cotton production away from some solvent plants. If the available capacity of these plants were utilized, it would produce 325,000 to 700,000 tons of edible oil, depending on the type of seed processed.

Some of the unused processing capacity would require rehabilitation to improve efficiency. There is sufficient private sector venture capital to rennovate the plants, but no investments will be made until current price and marketing restrictions are removed.

Table 3. Oil Extraction Capacity and Utilization

Type of Plant	Tons ('000) Total	Utilized	Available	Percent Utilized
Expellers	3,200	1,470	1,730	46
Solvent	500	200	300	40
TOTAL	3,700	1,670	2,030	45

Source: USDA/OICD estimates.

D. Other Resources

These primary physical resources are buttressed by a number of other key resources including:

- The capacity and inclination of the Pakistani farmer to respond to market-oriented production incentives and to adopt profitable new technology. The history of wheat and rice and the more recent dramatic response to increased sugar prices prove this point.

- An abundance of managerial talent and entrepreneural enthusiasm in the private sector.

- Agricultural practices and cropping patterns that are suitable for introducing nontraditional oilseed crops.

- A rapidly growing demand for quality poultry and the high protein feed that it requires, and a potential longer-run demand for similar feed for other livestock.

- The basic infrastructure necessary to support the expansion of the oilseeds industry in addition to the underutilized processing capacity.

IV. THE PROPOSED STRATEGY

A. The Strategy as a Whole

The strategy involves a set of interrelated policies and ensuing actions that will remove constraints to edible oils production, marketing, and consumption. Addressing one constraint and ignoring others will not produce the desired results.

B. Private Industry as the Engine of Change

Successful oilseed promotion programs all over the world depend primarily on the willing participation of three essential participants--the farmer, the processor and the consumer--and the utilization of existing infrastructure. All participants must see an opportunity for economic gain or to satisfy a demand or need. The private sector oilseed processor, who has established links with both farmers and consumers, is the natural focal point to lead and coordinate oilseed promotion in the locality where he purchases oilseeds for his operations.

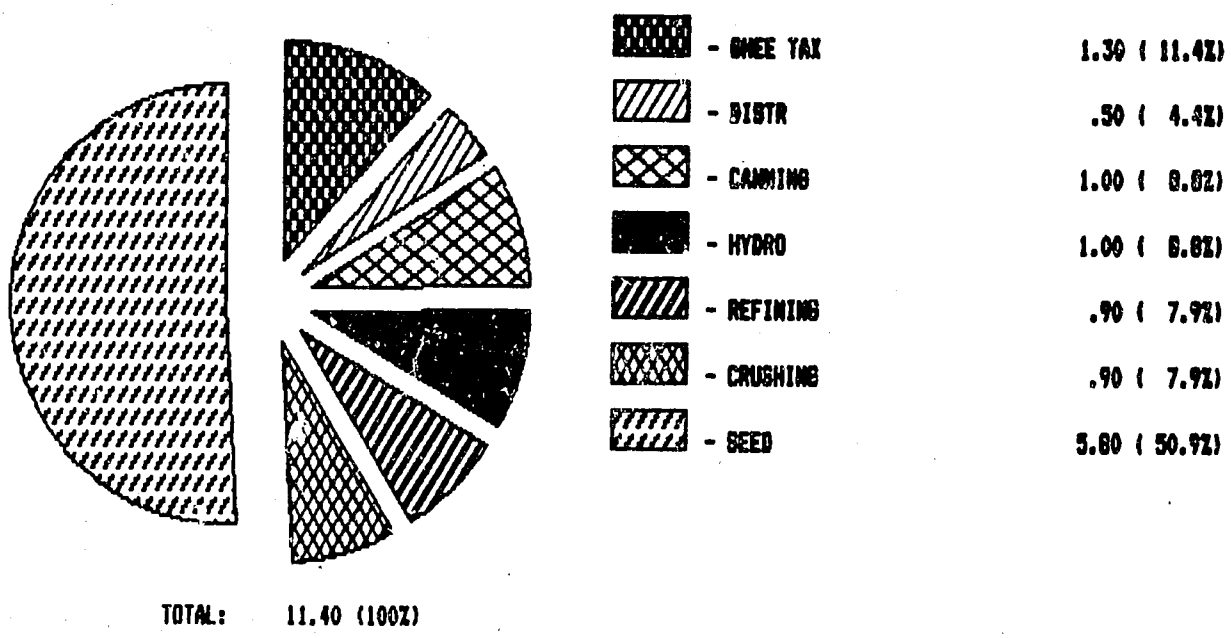
Thus, the processor essentially becomes the primary engine of change. The combination of a free market and significantly increased prices for crude edible oil that will result from an appropriate increase in the price of ghee will provide both the incentive and the means for processors to perform this role. As retail prices rise, oilseed processors will find profit opportunities by:

- Contracting with farmers to buy their production at a specified minimum price.
- Utilizing usual marketing channels in gathering oilseeds.
- Providing cash payment on delivery, either directly or through middlemen.
- Providing quality seed and necessary inputs to farmers on a timely, continuing basis.
- Providing technical information and assistance to farmers.
- Promoting oilseeds by use of the media and direct contact.
- Selling meal, cake and other by-products.
- Selling oil on the open market in direct competition with imported oil, or refining it and selling it directly to consumers.

Initially, oilseed crushers are likely to work primarily through direct advance contracts with farmers to purchase their oilseeds and provide them the necessary support services. Past experience shows that this type of advance contracting coupled with an adequate incentive price has a very rapid spread effect. It has worked successfully in Pakistan for sugarcane, tobacco and corn.

As a raw good passes through the marketing chain enroute to the final consumer, each processor or trader will not handle the good unless he will earn a "normal" return, comparable to his opportunity cost of handling some other good or performing another job. Figure 3. shows an estimate of the various cost components for a kilogram of vegetable ghee produced from domestic oilseed during the first quarter of 1983. At that time, the farmer recieved about one-half of the consumer's expenditure for ghee. The crushing, refining, hydrogenation, canning, and distribution costs add about Rs 4.3 to the retail price of ghee. This margin is not excessive and, it might decline slightly if the private sector expands its role in the industry. The costs of one kilogram of vegetable ghee in Figure 3. sum to Rs 11.4, yet the retail price is only Rs 10.7. The estimated Rs 0.7 excess of costs over returns offers another example of the need to restructure edible oil prices.

Figure 3. Retail Vegetable Ghee Marketing Margins (Rupees)



Source: USDA/OICD estimates for one kilogram, first quarter, 1983.

C. Farmer Response

Studies of agricultural innovation and diffusion all over the world have shown nearly identical farmer adoption patterns, under reasonable price incentives. There is ample evidence that this pattern could repeat itself with oilseeds in Pakistan. Once introduced, modern varieties of wheat and rice spread in this country with amazing speed. A corn products manufacturing company has been remarkably successful in introducing hybrid seed corn to farmers who contract to grow corn for the company. Oilseed crushers could produce similar results.

Moreover, the technology is straightforward and known. Safflower is already widely dispersed over the country. Sunflowers are already grown on a number of farms to provide the necessary base of experience. The linear programming model described earlier is based on an average sunflower production of 450 kg per acre. This is more than the present average of 270 kg, but far below the demonstration yields of 700 kg per acre that have already been achieved in this country. Much higher yields are possible with quality improvements in the input delivery system and the research and extension institutions.

D. The Proposed New Policy

To reduce the country's dependence on imported edible oil through market mechanisms, the following policy actions are required:

- Any firm--in either the public or private sector--would be free to import edible oils, but the resale price to refineries would be set by the GOP to equal the retail price of vegetable ghee, minus normal marketing margins from the refinery. In other words, the price of imported oil to the refinery, plus refining, hydrogenation, canning, and distribution costs (currently Rs 3.4 per kilogram, Figure 3.), plus taxes, should equal the retail vegetable ghee price. This system would provide a simple means of dealing with fluctuations within the international market. When world oil prices exceed domestic prices, refiners would have clear incentives to try to purchase more domestic oil. When world prices are low, as they were in early 1983, this import pricing mechanism would raise the effective price of imported oil to the refineries and maintain incentives to demand more domestic oil.

- The retail price of vegetable ghee should be allowed to rise to the Indian border price, in order to bring the domestic edible oil market into equilibrium with the world market and allow edible oil prices to vary according to the fundamental forces of supply and demand.

- The current vegetable ghee tax of 12.5 percent of the retail price should be retained and also applied to palm oil, which is often sold as ghee. The tax has the effect of making ghee relatively more expensive than liquid cooking oils, which are healthier than either ghee or palm oil and less expensive to manufacture than ghee.

- The private sector should be free to establish oil refining and processing facilities and purchase as much oil or oilseed as needed.

- All producers, processors, and traders should be free to earn normal returns on their labor and investment.

- The private sector should have open access to the market for cottonseed oil. The Ghee Corporation of Pakistan would no longer be the monopsony buyer for cottonseed oil, but it would be free to make purchases on the open market at the prevailing market price. This action is necessary to initially attract private firms into the processing market. They will not enter the market without adequate supplies of oil for processing, and an additional supply of oil will not be produced until they do enter the market and become competitors.

- The current ceiling price for cottonseed oil should be eliminated. It is not administratively feasible for the edible oil market to be operated half controlled and half free. Also, a higher cottonseed oil price is a prerequisite for generating the price signals to oilseed crushers which will induce them to improve their crushing efficiency.

- The present oilseed support prices should be maintained to give farmers a sense of a price security floor. There should not be a formal government procurement program for oilseeds.

F. Government Organization

There has been considerable discussion within the Federal Government, the Provincial Governments and the private sector about the necessity of establishing a mechanism for overall coordination of the oilseeds sector. Some have even suggested a supra-national oilseeds development authority reporting directly to the President. It is a major conclusion of this study that such an organization is not needed, and indeed, that its establishment would be counterproductive. The creation of such a supra oilseeds authority would only detract from the actions that need to be taken now, and invaluable time would be lost. The Oilseeds Development Board, with some refinements, can

and should provide the necessary overall focus and coordination for the oilseeds sector.

The Board, established in June, 1981, is to serve as an advisory board to the Food and Agriculture Division of the Ministry of Food, Agriculture and Cooperatives. Its mandate is comprehensive and it ranges from oilseed production to oil extraction and arrangements for oilseed price supports. Membership is equally broad and appears to represent the varied interests of the oilseed sector. However, there is no provision for representation from the private processors of oilseeds and vegetable oils. This should be corrected.

Despite the fact that its charter and composition are both broad, it appears that the Board has not been the effective force for oilseed production that was originally envisioned. The reasons for this are undoubtedly complex, but there is one step which could be taken to strengthen the work of the Board. There is no specialized staff at present and the Board is dependent on its member organizations or outside consultants for necessary staff work. A permanent specialized staff to provide reliable, unbiased, and coherent information and assistance should be assembled quickly.

While no major organizational changes are required by the proposed strategy, it would require a shift in the role and function of the Ghee Corporation. Under the strategy:

- The GCP would compete with all other refiners to purchase either imported or domestic edible oil. It would pay the same internal resale price for imported bulk oil as private firms.

- Until its plants can be denationalized, the GCP would be the major producer of vegetable ghee. However, it would be competing with private firms in the open market. It would similarly compete for the purchase of domestic crude oil and would no longer be the monopsony buyer. It could continue to promote nontraditional oilseed production, but it would procure only those oilseeds needed for its operations at market prices, which would be higher than current prices.

V. ALTERNATIVE PRICE LEVELS

A. Basic Principles

To break the current stalemate in the domestic production of edible oil and the pattern of spiraling consumption and imports, the retail price of ghee must increase. In determining the new price, several basic principles should be followed:

- For any alternate price level to be effective, it must operate through a free market system.

- The retail price must be allowed to send a clear signal to the processing sector, and through it, to the farmer.

- The price must be high enough to allow adequate margins for private industry beyond just the direct costs of processing. They should also include the risk of re-entering the oilseed processing business, the costs of promoting oilseeds with farmers, and of assisting and advising farmers on cultivation techniques, applications of seed and fertilizer, and pest management.

- The price should be high enough to dampen the rate of increase in the overall consumption of vegetable oil without placing a real burden on low income consumers.

- The price should be high enough to allow an effective differential between ghee and liquid cooking oil.

- The price should also be in approximate parity with the border price to reflect the country's true competitive position.

B. A Price Simulation Model

A price simulation model was developed to predict the effects of alternative retail prices on the supply and demand for edible oil in a free market situation. It predicts the domestic supply and consumption of edible oil that will result from a given retail price for ghee. These, in turn, are used to calculate related values such as import requirements, foreign exchange costs, government revenues and total farm income.

In this model, the calculated additional oil production is based on sunflowers because of their very high oil content (38 percent versus 17 percent for soybeans), and their potential high net return to the farmer. The price farmers currently receive for oilseeds is approximately 86 percent of the value of the oil produced and this ratio is also used in the model. The price of liquid cooking oil is assumed to be uncontrolled and to lag behind vegetable ghee price increases by at least Rs 2 per kilogram.

The model simulates the effects of alternative vegetable ghee prices under conditions of the recommended new policy. The simulation assumes that price effects are instantaneous. They obviously are not. It is not possible to predict precisely how long it would take for the price effects to become fully effective, but is the consensus of informed specialists that a reasonable estimate would be two or three years. This would allow sufficient time for the private sector to react to higher retail vegetable ghee prices and allow the farmers to respond with higher production. Past experience in Pakistan (e.g., sugar cane) indicates that farm production would quickly move towards the predicted production level after the first year. This is usually when the effects of farmer experience with the production and profitability of a new crop begin to accumulate.

In order to demonstrate the consequences of vegetable ghee price increases, a simulation was run to predict the effect in 1982/83 of a decision to raise the price of ghee to the Indian border price. The simulation is based on production and consumption benchmarks estimated for 1982/83. It is not appropriate to run the model based on the current 1983/84 period because the estimated production and consumption benchmarks would be far too speculative.

The model's predicted changes in other edible oil policy parameters due to a vegetable ghee price increase are summarized in Table 4. The simulation is dated because imported oil prices have almost doubled since March, 1983. However, the effects of the vegetable ghee price increase are still relevant for all policy parameters in Table 4., except foreign exchange cost and GOP revenue.

The model, based on the recommended new policy, calculates that if refineries pay Rs 9,725 for a ton of imported vegetable oil, the retail price of vegetable ghee produced from that oil would have to be sold for Rs 15 per kilogram in order to pay the ghee tax and normal processing and marketing costs. Imported soybean oil is now quoted at more than $800 per ton (Rs 10,800). Therefore, if the recommended pricing scheme were now in effect, vegetable ghee produced solely from imported soybean oil costing Rs 10,800 per ton would have to sell in the retail market for about Rs 16.2 per kilogram in order to recover normal production and marketing costs. Conversely, if the Ghee Corporation now produces ghee from only imported soybean oil, the GOP must provide a subsidy of at least Rs 5.5 per kilogram.

The government revenues in Table 4. include the ghee tax and an excise tax equivalent to the import oil sale price to refineries minus Rs 5,100 per ton (the assumed 1982/83 border crude oil price). At present import prices, the excise tax is now the subsidy described above. If Pakistan imports the same amount of oil during 1983/84 as during the previous year, its foreign exchange cost will almost double.

Table 4. Effects of Alternative Vegetable Ghee Prices, 1982/83

Policy Parameter	Policy Now	Policy New	Change Amt.	Change %
Retail Ghee Price (Rs./Kg)	10.7	15	+4.3	+40
Import Oil Sale Price (Rs/MT)	6,700	8,850	+2,150	+32
Total Consumption ('000 MT)	861	808	-53	-6
Vegetable Ghee ('000 MT)	689	578	-111	-16
Cooking Oil ('000 MT)	112	180	+68	+61
Industrial Use ('000 MT)	60	50	-10	-17
Domestic Oil Production ('000 MT)	299	479	+180	+60
Oilseed Meal and Cake ('000 MT)	734	874	+140	+19
Million Hectares of Cropland	2.67	3.09	+0.42	+16
Labor (000 Man Years)	544	574	+30	+6
Imported Oil ('000 MT)	562	329	-233	-41
	Million Rs			
Foreign Exchange Cost	2,866	1,677	-1,189	-41
Net Farm Income	1,943	3,227	+1,284	+66
Total Government Revenue	1,821	2,605	+784	+43

Source: USDA/OICD estimates, assuming a border crude oil price of Rs 5,100 per ton, as of March, 1983.

If the GOP waits until 1985/86 to raise vegetable ghee prices, it will require 852,000 tons of imported oil, costing $639 million at current import prices, to meet consumption requirements (Table 1.). The three-year delay would create new policy risks and further stagnate the domestic oilseed production and processing industries. Similarly, negligible increases in the ghee price, even if adopted now, would have little effect either on production or on Pakistan's import dependence and foreign exchange problem.

D. Specific Policy Effects

Consumer Impact

The proposed price increase will inevitably have some adverse impact on consumers, particularly lower income groups. Edible oil consumption per capita would decline one-half kilogram, to about nine kilograms per year. The annual edible oil expenditure per capita would rise from Rs 103 to Rs 135. However, the increased cost would be mitigated by two factors. The first is that as the price of ghee is allowed to rise to the target border price, demand will weaken and soften the rate of the price rise. The second factor is that, under the proposed strategy, liquid cooking oil will sell for at least Rs 2 per kg less than ghee. As a result, the effect of the price increase will be 47 percent less for those households that elect to switch from ghee to the healthier liquid oil. However, this change in consumer preference will be gradual, or nonexistent if the ghee price is only allowed to rise gradually.

Farm Impact

These consumer effects must also be weighed against the positive effects of the proposed strategy, particularly the inpact on farm communities. Most of the predicted 30,000 man-year increase in employment would be required for cultivating additional oilseed crops. The additional farm employment requirements and the expected increase of Rs 1.3 billion in total farm income will stimulate the farm sector directly by those respective amounts, but will also generate important indirect benefits through the multiplier effect on the non-farm economy. Depending on the average amount of oilseed acreage per farmer, this increased income will benefit between 200,000 and 400,000 individual farmers. Two-thirds of them will be smaller farmers (under 12.5 acres), and about one-third will be tenant farmers.

The simulation model predicts that a 40 percent increase in the retail price of vegetable ghee, along with the other recommended changes in edible oils policy, would lead to an additional 420,000 hectares of oilseed crops (sunflowers are assumed) within three years. This acreage response appears overly conservative when compared to the available oilseed acreages in Table 2. and the technical analysis of the linear programming model, but it represents a reasonable specification of the farmer's response under actual risk and uncertainty conditions.

Oilseed Processing

An increased domestic price for crude oil will affect the oilseed processing industry in these ways:

- Industry processing capacity will be increasingly utilized and the present seasonality problems will diminish.

- Solvent plants will come back into production and the available solvent capacity will be fully used. Higher crude oil prices will make solvent extraction profitable, even if the resulting meal must be sold at a discount.

- The oilseed processing industry will gradually modernize. The operators of the larger Lahore Expeller plants may find it profitable to install de-linting and de-hulling equipment because the additional oil they can get will more than offset the decreased volume of oil cake they will produce. The results will be more edible oil and a more nutritional oil cake. Solvent plants will add similar equipment, primarily because it is necessary to produce export quality oilseed meal and the increased return from the meal will more than pay for the equipment.

- Additional solvent capacity will be installed over time. The profitability of solvent plants compared to Lahore Expellers is a direct function of crude oil prices. If these prices are high enough, new solvent plants will be built. But unfortunately, past experience and the relative efficiency of Lahore Expellers will make this a gradual process. There will be no sudden disruption of the extraction industry.

Oilseed Meal and Cake

Pakistani farmers currently prefer the oil cake produced by Lahore Expellers because the higher oil content of this cake provides calories that their animals need and they are willing to accept the relatively useless fiber content to get the calories. But this preference is not immutable. Given time and the proper price incentives, this preference will change. The proposed strategy will provide both the incentives and the time.

Solvent plants will be producing meal that is quite different from the traditional cake, but it will be in strong demand for poultry feed. A Rs 15 per kg ghee price would produce an estimated 140,000 additional tons of cake and meal by 1985/86. With present underutilization, all of this additional meal could be solvent extracted. Initially, the remaining meal will have to be sold at a discount from conventional cake that is large enough to entice farmers to buy. No data exist to predict how much of a discount is required, but it certainly is within the range that would be profitable with the expected higher oil prices.

Dehulling equipment is relatively cheap and easy to install, and this may happen fairly quickly. Even if it is installed in all

of the solvent plants, the internal price of about Rs 2,600 per ton would make the resulting meal competitive and readily saleable on the international market. Moreover, there is a current potential market for 90,000 tons of low fiber meal for the modern poultry industry in Pakistan. At present growth rates, this market will double in five years.

If there is a gradual shift away from expellers to solvent plants, the livetock feed market will probably adjust to it. Market forces will create a supply/demand equilibrium between conventional cake and improved meal, and farmers will change their feeding habits accordingly.

Other Benefits

There are a number of other benefits to be derived from the oilseeds strategy described above. Clearly, it can form the basis for a modern feed industry. The seven modern labratories currently being established under FAO sponsorship will provide the analytical resources to help improve feed testing. The oilseed strategy will meet the critical second requirement--that of providing high quality, low fiber meal. Other actions will undoubtedly be necessary, but the foundations will be laid by this new edible oils marketing policy.

VI. GOVERNMENT RESPONSIBILITIES

A. General

The free market oilseed strategy as outlined above can produce rapid and dramatic results. They are, in most cases, linked directy to supporting government programs. It should be noted, however, that the immediate short-term gains which can be introduced by a select core of policy and strategy decisions will only endure if the long-term institutional building blocks are put into place. The necessary government programs to support these short-term gains will take time to produce results even though they will build on a base of existing activities. New varieties of oilseed cannot be developed in a year or two, nor can research stations be strengthened overnight. Consequently, these programs must be started now.

What follows is a summary of those elements of the technical reports dealing with government programs to support a long-term expansion of the edible oil sector. Further work will be required to draw on the existing reports to build a single integrated, long-run government oilseeds program in four main areas:

- Crop Production and Research
- Animal and Poultry Feed
- Poultry
- Livestock

B. Crop Production and Research

<u>Crop Production</u>

In the next few years, primary reliance may well be on the expansion of sunflower production. Yet there is a limit to how far this can be pursued. For this reason and because different crops have different advantages, work should be accelerated on the production of alternate crops. (For example, soybeans yield about half the amount of oil that can be obtained from sunflowers, but a highly successful soybean-wheat rotation has been developed in Brazil that takes advantage of soybean's ability to put nitrogen into the soil.) As oilseed production spreads, unpredictable problems may develop. For example, a sunflower-cotton rotation might incur a disease problem which passes back and forth between the two crops. The research base needs to be expanded upon so that these problems can be dealt with on a more systematic basis when they arise.

There are some significant and encouraging developments in Pakistan related to oilseed production that will help provide a foundation for alternative crop production and research. They are:

- A small nucleus exists of high caliber professionals interested in, and knowledgeable of, oilseed production.

- Reliable information on cultural practices and varieties that will increase yields substantially is available. It only needs to be transferred to farmers in a more effective manner.

- Machinery use and manufacture is increasing, and improved designs for specific purposes are being developed.

- Some seed companies have been formed which are eager to develop in-country programs to supply high quality planting seed for oilseed crops.

- The National Seed Council, through the Seed Registration Council and the Seed Certification Service, has the basics in place for testing high quality seed of superior varieties as required.

- A National Agricultural Research Network, which is potentially capable of providing the basic research for an expanded program of development and adaptive research on oilseed crops, is underway.

- A Program for developing improved varieties of rapeseed and mustard is currently underway in cooperation with the Canadian Government.

Five projects can be readily identified which might form the initial agenda for crop production research. These projects have one pressing common denominator--training. There are simply not enough trained personnel available. Five potential crop production projects are:

- **A Machinery Improvement and Development Project.** Machinery improvement is needed to provide better seedbed preparation in dobari lands; better planting equipment for all oilseed crops; better threshing equipment for all oilseed crops; and better diggers, pickers and shellers for groundnuts. This project will interface with many other projects.

- **A Dobari Lands Project.** A strong research and development program which interfaces with the proposed Machinery Development Project is necessary to overcome

difficulties in land preparation, seeding and harvesting on Dobari lands.

- A Seed Production Project. The disadvantages of the present delivery system for high quality planting seed of oilseed crops are: large volumes are imported at high costs; levels of germination in both imported and local seed are frequently low due to improper handling and storage; delivery and receipt of planting seed is delayed; and the technology of producing hybrid varieties is not well known. A major constraint to the expansion of nontraditional oilseed crops could be alleviated or eliminated by a program that focuses on areas suitable for seed production and needs for insect pollinators, seed storage, and seed cleaning and handling equipment. This project should be aimed at providing strong incentives to the private sector.

- A Legume Inoculum (Nitrogen Fixing Bacteria) Project. The successful development of soybeans and groundnuts requires an in-country supply of low cost, high quality nitrogen fixing bacteria. This can best be supplied by a commercial company with skills in preparing inoculum which retains its efficiency in nitrogen fixation between production and use.

- A Cotton-Fallow Project. A cotton-fallow research and development project would improve yields through the introduction of better cropping systems. It also interfaces with the Machinery Improvement and the Inoculum Development projects.

Research

An expanded program for strengthening oilseed research is needed to support the above projects, as well as to provide the capability to identify and deal with other agronomic problems of this sector. Such a program requires further definition, but could include:

- Significantly more on-farm adaptive research, including socio-economic analysis.

- Research on the feasibility of oilseed production in areas lying idle, fallow or poorly used at climatic intervals of the year.

- Increased budgets for oilseed research, recognizing that several oilseed crops must be emphasized. Also, more effective use must be made of existing office space, laboratories and field areas to support the oilseed program.

- Placing an additional Oilseed Research Coordinator at the Pakistan Agricultural Research Council (PARC) to handle the expanded program.

- Consider the appointment of expatriate oilseed advisor(s) to the Oilseed Research Coordinators as has been done for several other major crops.

- Improving linkages among oilseed researchers and the Extension Service and the Seed Divison of the GCP.

- Extending and improving internal training programs with short-term advisory assistance where appropriate.

- Improving the management capacity in PARC to facilitate timely transfer of research funds to provincial research institutes.

- Substantial long and short-term training. Training, both degree and short-term, is a necessary part of the crop development projects, and for more general support of the oilseed research institutes. Some training could be structured to provide course work at a U.S. or other foreign university with the research being undertaken in Pakistan or at an international research center on problems directly relevant to Pakistan. Higher education institutions should be strengthened with more curricula in oilseed related areas.

C. The Feed Industry

The predicted increase in oilseed meal supply does not appear be a problem over the next three years; however, continued growth of oilseed production could produce a meal surplus. One viable solution is a growing internal market for the meal, preferably for use in commercial production of feed for poultry, dairy animals and livestock (cattle, sheep and goats).

Often in the past, a livestock feeding program has been viewed as an essential requirement for increased oilseed production, and such a program simply cannot be created quickly enough to do the job. Fortunately for Pakistan, the solution, at least for the next five years, is readily available in its modern poultry industry. Both modern commercial and desi (native) poultry production have been increasing at the rate of 16 percent a year for the last decade. With demand still greater than supply, and favorable government policy incentives in place, this phenomenal growth is forecast to continue. At this rate commercial flocks will require about 600,000 tons of feed by 1985. The availability and quality of this feed are vital to the poultry industry. Commercial flocks need a constant supply of concentrated, nutritionally-balanced diets, and feed costs make up 55 to 75 percent of the cost of producing poultry. Because of this, and because the presence of aflotoxins and other toxic agents in

feeds contributes to the current high poultry mortality rates, the quality of prepared feeds and their ingredients is probably the largest single factor affecting the further development of a profitable commercial poultry industry in Pakistan.

Feed testing laboratories are being established; a supply of low fiber, high protein meal is in the offing; and a fledgling feed mill industry exists. Two activities need to be stressed now.

- The first is a program to study the requirements and sources for the other feed ingredients, principally calories. If all of the calorie requirements were met with maize, which is generally the most economic source, poultry feed in 1985 would require about 400,000 tons of maize--40 percent of today's total maize production.

- The second need is for a regulatory system which will insure that feed producers receive ingredients that meet minimum standard requirements and that the feeds they produce and sell do the same. This involves the development of:

  - Official standards for each major feed ingredient to insure that the purchaser is receiving a standard ingredient that meets minimum nutritional requirements. For example, each type of oilseed meal should have a standard set for maximum moisture content and crude fiber, and minimum levels of crude protein, ether extract (fat) and minerals.

  - Laws and regulations to require feed manufacturers to label their products so that the purchaser knows the minimum and maximum levels of each nutrient included in the particular mixed feed.

  - A feed regulatory agency or system to insure that the standards and guarantees are being met. This agency should sample both ingredients and mixed feeds, check analyses and handle complaints.

D. Poultry Production

Despite its phenomenal growth in both supply and consumption, there is room for even greater growth in the commercial poultry industry. Current high prices attest to the fact that latent demand exists and current consumption (29 eggs and 0.46 kg of poultry meat per person per year) is very low compared to other countries. Poultry is still a prestige food in Pakistan. Because of this the Ministry of Food and Agriculture estimates that the real demand for poultry and eggs, which could be tapped by somewhat lower prices, is nearly double current production.

Increased poultry production also provides the best opportunity for increased demand for oilseed meal because (1) it is definitely feasible now, (2) feed quality is critical to commercial poultry production and (3) poultry feed is economically and nutritionally the most effective use of high protein oilseed meal short of direct human consumption. There are two project areas which offer considerable promise for prompt increases in poultry production.

Poultry Management and Disease Control

Mortality levels in both broilers and layers are extremely high. A reduction in current mortality rates probably offers the greatest potential for reducing the costs of producing both eggs and meat. Reports indicate that mortality levels average 30 percent in commercial layers and 15 percent in broilers, with cases reported to go as high as 30-50 percent. A good poultry management education program should enable the industry to reduce these mortality levels by at least one-half. Good quality poultry vaccines are apparently readily available from the research institutes and if administered properly in well managed operations, these goals should be attainable.

Three programs are needed:

- Poultry management programs to train and assist the operators of breeder, hatchery, broiler and egg production flocks.
- Improved problem solving research programs in cooperation with the respective provincial research institutes.
- Practical, short-term training programs for selected poultry farm managers and extension workers.

Seasonal Demand for Poultry Meat and Eggs

Pakistani consumers currently eat less poultry meat and eggs during the summer. This summer decline forces farmers to sell egg producing flocks and reduce broiler production. This results in price inflation, selling poor quality eggs and hatcherymen selling everything that hatches during high demand periods. The resulting poor quality of chicks undoubtedly contributes to the high poultry mortality rates.

A program to equalize the demand for eggs throughout the year would permit more efficient use of breeder flocks, reduce the required number of breeders, contribute to improved chick quality, help stabilize meat production and related price fluctuations, and improve overall efficiency of the entire industry.

Consumer preferences may shift over time, but for the present, the practical solution to the seasonality problem is to establish egg processing plants in the major egg production areas (population centers) to utilize eggs during the low demand periods. Products produced could include liquid whole eggs, albumen and yolks that could be produced either on a fresh or frozen basis, and dried albumen, yolks and whole eggs. In many countries, these products are readily accepted by the institutional users of eggs such as bakeries, mayonnaise and salad dressing manufacturers, ice cream manufacturers, baby food producers, etc. To begin , private industry might establish a pilot plant, preferably in the Karachi area where layer population is high.

Longer Term Poultry Related Projects

Feeding poultry wastes as a protein source. Poultry manure is very high in nitrogen (protein) because birds excrete uric acid in a semisolid state rather than liquid urine. Ruminant animals are capable of using this uric acid nitrogen as efficiently as they use other nitrogen sources such as urea. Poultry farms and many of the buffalo colonies are concentrated in the fringe areas of the urban centers. With this close proximity of the herds and flocks, poultry wastes could be used as a feed ingredient for the buffalo.

Poultry by-products processing. Poultry processing in Pakistan is currently handled in village or urban markets and most by-products (viscera, blood, skin and feathers, some head parts and feet) are apparently disposed of in garbage or in the sewers, rather than utilized as a valuable by-product. These by-products could be used to make meat, blood and feather meal for use as high protein supplement in poultry and livestock feeds. Also, the collection and use of these products would decrease human health problems brought on by improper disposal methods.

E. Milk and Livestock

This study also examined the potential for increased milk and livestock production because of its potential as a market for oilseed meal. The results are not promising. Current prices for milk and for meat, especially beef, are depressed by such actions as meatless days, a ban on exports, limitations on interdistrict shipments and price controls. At these prices it may be economical to develop feedlot operations for sheep and goats, but not to modernize the dairy industry or to feed buffalo and cattle expressly for meat production. As a result, this study has little that is specific to recommend with regard to dairy cattle and livestock.

But over a somewhat longer period of time (i.e., five years or more), dairy and livestock production will have to begin to modernize if it is to absorb the increasing quantities of oilseed meal (and even cake) that will become available. Work on these

problems will have to start now. They involve complicated interactions and cultural changes that will not be resolved quickly. It is beyond the capability of this study to recommend what needs to be done to vitalize dairy and meat production in Pakistan. But available evidence indicates that if milk and beef prices are not increased, nothing significant will happen.

ADDENDUM

Pakistan's edible oils situation has often been described in terms of an impending crisis. However, the recent doubling of world edible oil prices has made everyone aware that the crisis is now with high foreign exchange costs for imported edible oil; mounting balance of payments deficits; a growing threat of widespread edible oil shortages; and a stagnant domestic edible oil sector.

This report was prepared in the midst of the Pakistan Government's deliberations to change its edible oils policy. After thoroughly evaluating 31 technical reports, the U.S. Department of Agriculture Oilseeds Consolidation Team recommended a major shift in the country's edible oils policy through a new pricing scheme and expanded competition in the private sector.

When the technical reports were prepared, the retail vegetable ghee prices had been fixed at Rs 10.7 per kilogram for the last five years. One of the major features of this report is the recommendation that the retail price of vegetable ghee be quickly raised to at least Rs 15 per kilogram, which approximates its inflation-adjusted price for the last five years and the lower limit of current vegetable ghee prices in India.

At this writing, the GOP has announced a 26 percent increase in the retail vegetable ghee price to Rs 13.5 per kilogram. This long overdue decision will reduce the government's edible oil foreign exchange and subsidy burdens. However, that action alone will have no effect on Pakistan's considerable edible oil production and processing problems. More retail vegetable ghee price increases must be contemplated. The pricing mechanisms must be restructured to moderate the devastating impact of high world oil prices and stimulate domestic oil production through strong price incentives and renewed competition in the private sector.

The conclusions and recommendations of this report stress an integrated approach to Pakistan's edible oils problems. Even though retail vegetable ghee prices have been raised, the report's findings remain relevant and timely.

PART II

THE OILSEED SECTOR
IN
PAKISTAN'S AGRICULTURAL ECONOMY

THE POLICY SETTING
OF THE OILSEEDS SECTOR IN PAKISTAN

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Agriculture is the mainstay of Pakistan's economy. It constitutes 30 percent of the gross domestic product (GDP), 36 percent of the foreign exchange earnings from export of merchandise and 53 percent of the employed labor. Major large-scale industries like textiles and sugar, as well as medium- and small-scale agro-based and cottage enterprises are dependent on agriculture for raw material. With its importance in mind, government has accorded high priority to the development of agriculture.

Pakistan has made impressive improvement in developing agriculture and achieved a high growth rate of six percent during 1979-80, compared with the previous year. But the chronic shortage of edible oil has persisted unabated for the last few years. Edible oil continues to be a major national import, varying from five to eight percent of total imports during the last five years.

I. AGRICULTURE SITUATION AND OUTLOOK

Fiscal year (FY) 1981 was one of continued growth in the agricultural sector. While more modest than the 6.9 percent rate for FY 80, the overall rate of growth of 4.4 percent is still significantly higher than that of the early 1970's or of FY 77 to FY 79. As in FY 80, the performance of major crops was better than that of minor ones.

Among the major crops, wheat continued its upward trend, increasing in real value by 5.4 percent in FY 81, compared with the 8.1 percent increase in FY 80. At 11.48 million tons, FY 81 wheat production was a record high. Good weather with adequate water availability was a contributing factor, together with the upward revision in support prices, greater and possibly more efficient use of fertilizer and availability of agricultural credit.

In FY 81, rice production remained about the same as in the previous year. The shift in acreage from IRRI-6 into lower-yielding Basmati and lower precipitation at sowing time appears to have affected output adversely. The continued shift toward Basmati has been attributed to its higher, relative profitability and its greater resistance to pest attack.

Despite minor attacks by pests in some parts of Punjab and Sind, the cotton crop was about the same as for FY 80--an all-time high. At 32.36 million tons, sugarcane was also a record crop and some 17.7 percent above the FY 80 level. As a result, near self-sufficiency was achieved for sugar.

In recent years, increases in the production of wheat, rice and other foodgrains have been sufficient to increase per capita

availability[1] above the levels of the early to mid-1970's, while reducing Pakistan's dependence on wheat imports. During the past two years, self-sufficiency in wheat has virtually been attained; domestic supply has been sufficient to meet domestic demand; and minor amounts of imports have been used to build up reserves. In FY 81, the decline in availability arising from increased rice exports, lower wheat imports and increased government procurement of wheat was more than matched by the increased production of wheat and other foodgrains (mainly maize).

At 155.64 kgs/annum, per capita availability remained at the FY 80 level--some three percent higher than the FY 72-75 average. With wheat imports and rice exports remaining at FY 81 levels, increased production of wheat and rice in FY 82 is expected to lead to a four percent increase in the per capita availability of foodgrains. At 250,000 metric tons, wheat imports have fallen by 75 percent since the mid-1970's and now are equivalent to only two percent of annual production.

For FY 82, the government estimates that overall agricultural production will grow by about five percent. For the Kharif,[2] preliminary estimates suggest a successful season for the major crops, with rice growing at 2.7 percent, cotton at 4.5 percent and sugar at 5.2 percent. This performance was assisted by favorable weather conditions and by improved availability of the major agricultural inputs.

For the Rabi,[2] a target of 12.2 million tons has been set for wheat, some 6.3 percent above the estimated output for FY 81. While the recent performance of this crop has been impressive, much will depend on weather conditions, availability of water, offtake of fertilizer, timely availability of other agricultural inputs and agricultural credit. Lower than normal water availability at the start of the growing season has raised some questions about whether the FY 82 wheat target can be attained, but preliminary indications suggest that production may be in the 11.5 to 11.7 million ton range.

II. REVIEW OF GOP AGRICULTURAL POLICIES

The agricultural sector continues to dominate Pakistan's economy. It provides over 30 percent of GDP. Over three-quarters of the population reside in rural areas and about 55 percent of the labor force is employed in agriculture. Agriculture is a major supplier of raw materials for industry and the

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[1]Availability is equal to domestic production, plus imports, less exports and amounts added (mainly by government) to storage.

[2]Kharif and Rabi are the summer and winter crop seasons, respectively.

most important source of exportable surpluses. To improve its contribution to growth, employment and international trade, the Government has been undertaking measures directed toward (a) the reorientation of public development expenditures in agriculture and water; (b) the provisión of incentives for increased output and efficient use of inputs; and (c) the progressive diversification of the sector.

Past investments in the agricultural sector have created a substantial infrastructure, giving Pakistan the potential to manage its water supplies to meet crop requirements and substantially increase crop yields. Carefully targeted expenditures are now required to convert this potential into actual capacity by improving the efficiency of the irrigation system. The irrigation efficiency of the Indus Basin System has been estimated at less than 40 percent. More than half the gross inflow into the canal system is not being used productively, with a substantial proportion of the loss occurring in watercourse commands. These losses have reduced crop production and, together with low utilization rates for public tubewells, have contributed to a serious drainage problem. In about 60 percent of the Indus Basin, the water table is within ten feet of the land surface.

Investments such as watercourse improvements and canal rehabilitation therefore promise high returns, not only because of increased water availability for crops but also because of reduced need for investments in drainage. The Government's Three-Year Public Sector Development Program (FY 82-84) provides for a substantial shift of resources toward the water sector and specifically toward projects for the rehabilitation of the irrigation system, watercourse and on-farm improvements and necessary drainage in waterlogged and saline areas.

To increase agricultural yields, additional efforts in such areas as extension, research, seed improvement and agricultural credit will also be necessary. The government's Three-Year Public Sector Development Program (FY 82-84) calls for a significant shift of resources toward both the agricultural and water sectors. Programs in extension have had varying degrees of success. The cotton maximization program and the use of radio in extension activities appear to have been effective. Following the introduction of the training and visit system (T&V) in Punjab and Sind (supported in some districts by International Development Administration (IDA) and Agricultural Development Bank (ADB) projects), increases in yields have been recorded.

To encourage higher agricultural yields, the GOP has been taking steps to improve farmer incentives through input/output price adjustments and increases in the supply of agricultural inputs and services at the farm level, while reducing input subsidies to release resources for high-priority expenditures. In line with this policy, the procurement prices of all major crops were raised in FY 81; in addition, the prices of seed cotton, Basmati and IRRI-6 rice were increased in FY 82. Two years of increases have raised procurement prices substantially above their FY 80

levels: IRRI-6 by 31 percent; sugarcane 28.6 percent; Basmati rice 27.2 percent; wheat 16 percent; and seed cotton 14.9 percent.

Recognizing the need to establish a more systematic basis for price adjustments, the Agricultural Prices Commision (APC) was established in 1981 to provide the GOP with consistent and timely recommendations on input and output prices based on analyses of their effects on farm incomes and productivity, consumer prices and Pakistan's competitiveness in world markets. The APC is expected to be adequately staffed by June 1983. Its initial work program is aimed at (a) designing a system for the collection of on-farm data; (b) initiating and assisting the collection of data on international prices and production for all Pakistan's major crops; and (c) developing a methodology for measuring the effects of price recommendations on farmers' and consumers' real incomes. This work program would lead to the development of a methodology for preparing timely price recommendations (with supporting economic analysis).

Progress has been made toward the GOP's objective of reducing subsidies on fertilizer and pesticide inputs. As a result of the rapid expansion of demand and significant increases in international prices of fertilizer, fertilizer subsidies would have reached U.S. $375 million in FY 80 if internal prices had not been adjusted. Because of the 50 percent fertilizer price increase in February 1980, the fertilizer subsidy was constrained at U.S. $250 million in FY 80, and fell to U.S. $220 million in FY 81. Although the February 1980 price increase was followed by a slowdown in the rate of growth of fertilizer demand, there is some evidence that this was accompanied by an increase in the efficiency of fertilizer use. With the recent decline in world fertilizer prices, increased domestic fertilizer production and restrained demand, a further reduction in the subsidy to U.S. $200 million is epected in FY 82. The GOP's objective is to eliminate fertilizer subsidies by FY 85 through further price increases--accompanied by appropriate changes in crop procurement prices, while achieving a ten percent annual increase in fertilizer consumption to improve crop yields.

To reduce fertilizer subsidies, the government announced an increase in fertilizer prices in March 1982, amounting to five percent on phosphate, 7.7 percent on nitrophosphate and 10.8 percent on urea. Given projected increases in world fertilizer prices, sizeable additional annual increments in domestic fertilizer prices will be necessary to reduce the subsidy to zero by FY 85. To the extent that domestic farmgate prices are below world prices, it would be possible to compensate farmers for increased fertilizer and other input costs by raising farm prices without reducing agriculture's competitiveness in world markets.

The government's National Agricultural Policy stresses a balanced approach to all aspects of agriculture, including livestock, fisheries and new crops (e.g., pulses, fruits and vegetables), in additional to the four existing major crops (wheat, rice, cotton

and sugarcane). In the immediate future, the most intensive diversification efforts will be directed toward oilseed development. Since specialized oilseed crops are not grown extensively and current domestic production of edible oils is mainly a by-product of cotton production, supply has not kept pace with demand. Between FY 78 and FY 81, edible oil imports increased from U.S. $150 million to U.S. $280 million and are likely to increase further. To remedy this situation, the government has created a high-level Oilseed Development Board to provide advice on both the agricultural and processing aspects of production.

An oilseed development plan has been prepared that proposes (a) an expansion in acreage from 10,000 to 100,000 acres over the next three years for three nontraditional oilseeds (sunflower, soybean and safflower); (b) a gradual improvement in the yields of traditional oilseeds (rape and mustard) through improved extension work; and (c) improved extraction of edible oils from seed cotton, rape and mustard through the rehabilitation of existing plants. Initial experience with implementing the oilseed development plan indicates close attention to matters such as relative pricing, crop displacement and applied research will be essential to ensure the successful achievement of the plan's objectives.

III. EDIBLE OILS

Pakistan's edible oil consumption has increased dramatically from about 300,000 metric tons in 1973/74 to about 678,000 in 1980/81. This increase is the result of a growing population, expanded urbanization and increased per capita income. Pakistan's population is increasing at a rate of three percent per annum--one of the highest in Asia. Pakistan's consumption of edible oil has been increasing at an average annual rate of about five to ten percent.

Assuming these trends continue and assuming the income elasticity for edible oil remains at its present level of 0.7, Pakistan's consumption of edible oil will be 825,000 metric tons by 1985. This would create a shortfall in the range of 500,000 to 600,000 metric tons which must be met by imports of vegetable oil, particularly palm and soybean. According to officials of the Ghee Corporation of Pakistan, a 50 percent soybean oil and 50 percent palm oil mix is preferred for making vegetable ghee.

The per capita consumption of edible oil has risen from 6.43 kilograms in 1979/80 to 6.79 kilograms in 1980/81, and will likely increase to about 7.8 kilograms per capita per annum by 1984/85. Despite projected increases, Pakistan's per capita consumption lags behind other countries, e.g., Turkey's per capita consumption of edible oil is 9.2 kilograms per annum; Canada's is 9.7 kilograms; while Sweden's is 11.4 kilograms.

Cottonseed is the principal oilseed crop, accounting for about 54 percent of Pakistan's edible oil production, followed by rape and mustard seeds. While the cotton acreage increased slightly, cottonseed production dropped from 1.44 million metric tons to 1.37 million metric tons in 1981. Rape and mustard seed production are presently estimated at 250,000 metric tons--only a slight increase over that of 1979/80--while peanut and sesame production are expected to remain at the previous year's level.

The aggregate oilseeds production from all sources declined about four percent from 1979 to 1980. The GOP's oilseed production strategy has not yielded encouraging results during th past five years, and the main source of edible oil continues to be from traditional oilseed crops--cottonseed, peanuts, rapeseed and mustard seeds. Cotton is produced primarily for fiber and secondarily for oilseeds.

Apparently, at least a portion of the cottonseed crush was being sold outside the official GOP marketing channels. The government does not control the price of traditional oilseeds, i.e., cottonseed, rape, mustard and peanuts. However, the Ghee Corporation of Pakistan has a monopoly for procurement of domestic cottonseed oil which is purchased at an officially fixed price of Rs 250 per maund (82 pounds). Vegetable oil sold outside official channels is offered on the open (black or gray) market to numerous sweet shops and snack vendors in every village, town and city in the Indian subcontinent. Vegetable oil is used for deep frying of sweet and snacks. This could account for official statistics showing an increase in production. Several oil crushers explain that the extraction rate of cottonseed has deteriorated over the years.

IV. CONCLUSIONS

Pakistan imports about 450 thousand metric tons of edible oil. Consumption requirements are rising rapidly. If domestic production remains stagnant, imports will have to provide needed commodities, further exacerbating the balance of payments problem. In fact, unless the problem is addressed, Pakistan faces a $500 million annual edible oil import bill in a few years.

The complexities of the edible oil industry do not permit easy and quick solutions to production shortfalls. Expanded production of cottonseed, the primary source of domestic oil production, depends on the price of cottonseed meal for livestock feed.

The characteristics of the local varieties of rape and mustard seed constrain the use of these traditional crops for processing into vegetable ghee--the product sold to consumers. Yields are very low and the oil from the seeds has a high level of erucic acid which has several disadvantages including limited shelf life. Imported low-acid varieties are being examined, but large,

isolated fields are required to avoid crossbreeding with traditional varieties. Given the small holdings of traditional producers of rape and mustard seed, this is difficult to accomplish. Although limited amounts of peanuts are grown, they are consumed as nuts and not used to produce oil. While improved efficiency in production and processing can reduce imports, expanded production is thought to be possible only with significant increases in nontraditional sunflower.

Addressing the specific situation with edible oil imports, the GOP's goal is to prevent the increasing dependence of Pakistan on imported edible oil from becoming so severe that the economic and political situation becomes unbalanced. The GOP understands that self-sufficiency at all costs is not a rational objective. In other words, it hopes to decrease the growth rate of the edible oil import requirement to where it is fairly stable. This will be accomplished by increasing domestic production of edible oil to keep pace with the increase in demand.

A SOCIAL SOUNDNESS ASSESSMENT

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I. CONCLUSIONS AND RECOMMENDATIONS

1. In locating project sites, high priority should be given to identifying progressive landlords and active markaz council leaders. Their support and effectiveness as informal channels for the dissemination of information can be crucial to the success of the project.

2. To encourage the needed integration of extension and research personnel, interdisciplinary training sessions should be held for a mixed group of extension agents, cooperative bank officers, research station officials, agriculture department officials, irrigation department representatives and union council leaders. Whenever possible, these sessions should include agricultural extension field assistants and veterinary service stock assistants.

3. Although farmers have had an opportunity to observe the success of new methods in the wheat program and are interested in trying them, economic constraints often have prevented their adoption of many new techniques. Such constraints include limited access to credit, land tenure problems and inability to market small quantities.

4. Since radio reaches a wide segment of the rural population, it should be used as a first-line medium for the dissemination of technical information for an oilseeds project.

5. In the training and visitation (T&V) areas, the addition of an oilseeds specialist to the district specialist team would be one means of encouraging the healthy growth of more oilseeds.

6. The seed turnaround program of the Ghee Corporation of Pakistan (GCP) should be encouraged and used with traditional oilseeds as well as in pilot areas, but only under strict external monitoring to ensure a timely and honest delivery of services.

7. An oilseeds project should cooperate with small-scale, private marketing agents to encourage price-efficient market behavior to influence farm budgets and consumption patterns.

8. The project should assist the mechanical crusher sector, particularly by clarifying the licensing and registration procurement system. At the same time, the status of the kholus operators should be monitored, and where evidence of technical displacement appears, credit and training assistance should be provided.

9. The project appears unlikely to have a significant direct effect on women--either positive or negative. However, the special status of women in Pakistan should not be ignored.

Girls' schools or women's industrial homes in project areas should be supported. Where none exist, they should be encouraged. These centers provide a somewhat useful medium for the dissemination of home economics skills such as food preparation, processing and storage, and of such marketable skills as embroidery and tailoring. They may be used to disseminate information on the use of liquid cooking oil.

10. Monitoring and evaluation procedures should be granted a high priority in the design of a project to ensure an efficient implementation consistent with project goals. Technical and economic specialists should also include monitoring and evaluation procedures in their design proposals. Where possible, Pakistani individuals or institutions should be considered to help monitor and evaluate the project.

II. INTRODUCTION

A. The Country

Pakistan is a country of nearly 84 million people in a land area of 803,943 sq km. The population growth rate is around three percent per year. The Punjab is the most populous province with 47.5 million in 1981, followed by Sind with 18.9 million, NWFP with 13.1 million and Baluchistan with 4.3 million. About 72 percent of the total population is rural. There are 5,257 inhabitants for each physician. Access to safe water is available to 27 percent of the population. The adult literacy rate in 1978 was 24 percent. Primary school enrollment represented 51 percent of the total eligible, school age population.[1]

Geographic conditions in Pakistan range from snowcovered mountains, to fertile flatlands and to barren deserts. The social and economic systems show a similar variety, although Islam provides some basic commonalities from place to place.[2]

B. The Oilseed Project

Edible oils accounted for five percent of the total rupee value of imports in FY 1981, amounting to about $300

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[1]Statistics are taken from Pakistan Economic Development and Prospects, International Bank for Reconstruction and Development (IBRD), 1982.

[2]This report generally considers the three provinces visited as a unit since specific sites for a project have not yet been proposed.

million. Consumption is growing rapidly, while domestic production has stagnated or even declined. The preferred form of oil consumption in rural areas is called vanaspati--or more commonly, dalda--which refers to hydrogenated vegetable oil. Liquid oil is not used in villages and often is considered unhealthy. The preferred cooking medium is ghee or clarified butter made from buffalo or cow milk, but it is frequently beyond the means of the poor farmer.

The domestic oil supply comes primarily from cotton, rape or mustard seed. Cottonseed accounts for about 54 percent of total domestic supply. In most areas, locally processed mustard seed oil is used primarily for cosmetic purposes, i.e., on the hair. The principal alternative sources of oil being promoted are sunflower, safflower and soybean; they are still being grown on a limited scale.

C. Objectives of the Social Soundness Analysis

The overall objective of the social soundness analysis was to identify factors that could promote a harmonious integration of project technical activities with the socio-economic institutions and organizations shaping rural Pakistani life. The social soundness analysis is intended to (1) identify and describe the institutions, groups and administrative structures and arrangements which will affect or be affected by project activities; (2) identify the means by which the dynamic elements of the socio-cultural system can be harnessed in designing and working on the project; and (3) provide overall guidance to an oilseeds project to ensure conformity with the established socio-economic norms, values and customs.

At present, the social soundness anlaysis cannot specifically show whether certain technical proposals are available for a project, nor can it assess in detail the potential difficulties or advantages of specific project sites. It can, however, guide technical teams in preparing their own proposals.

III. MEANS OF ASSESSMENT

Data on which this report is based were gathered primarily during a field trip to villages in the NWFP, Punjab and Sind Provinces from November 21 to December 4, 1982. Individuals at various socio-economic levels, including tenant farmers, small landholders and major landlords were interviewed. Because of the limited time, only a few areas in each province could be visited. Thanks to local guides, it was possible to visit villages well off the beaten track and outside the immediate sphere of infuence of major urban centers such as Peshawar, Lahore and Karachi.

In the NWFP, the team was based in Saidu Sharif, Swat. Visits were made to villages in Malakand and Swat districts. A local agricultural extension officer accompanied the team in Swat.

In the Punjab, the team visited villages in Gujrat and Vehari districts. Access was provided to an influential innovative landlord in Multan Division, and faculty at the University of Faisalabad provided helpful information from their research.

In Sind Province, the team was based in Hyderbad and visited Thatta and Sanghar Districts. An opportunity was provided to visit a backward landlord with large holdings near Tando.

Farmers and their wives and local and provincial government officials, e.g., agricultural extension and credit officials, and social welfare department personnel were among those interviewed. Among women, it was very useful to talk with school teachers, principals and those running small industrial homes in villages. Representatives of the All Pakistan Women's Association (APWA), a voluntary organization, also provided relevant information.

IV. LOCAL LEADERSHIP

1. Local level leadership in most of Pakistan greatly reflects the rural social system where the large landowner takes the most prominent role. The relative size of the landholding varies from province to province, with the largest holdings in Sind, but land ownership clearly provides entree into community leadership.

2. Under the present government system, the only electoral system for local leaders is the union council. Representatives are freely elected by villagers, but all union council officials encountered on the field trip were also large landholders. This may be partly due to their access to financial resources, including free time for political activities, but also to the traditional role of the landholder.

   Land affords status and the respect of the community to its owner. Traditionally, it has also brought power over those who lived on it as tenants, craftsmen or laborers. In its more benevolent form, the large landowner might be seen as an elder, more experienced and wiser in the ways of the world outside the village. All of these reasons combine to make the landowner the most likely winner, if indeed he has an opponent at all, in union council elections.

3. From the field data, there were clearly two types of local leaders to take into account. One is the innovative landholder, receptive to new ways of doing things. He keeps informed about new agricultural practices and crops and is

willing to engage in a certain amount of risk by trying them. He is likely to be an active union council official and procures many improvements and services for his constituents. On the other hand, the non-innovative landholder fears change and resents government intrusion into his way of life. He is a despot. He farms his land as his forefathers did--even as his yields decline drastically. In many instances, change is viewed as intrusion and seen as a threat to the political domain of the landlord.

4. Although an ultimate aim of an oilseeds project is to spread its benefits equitably among the rural population, bear in mind that in most places small farmers cannot be approached directly without gaining the local, large landholder's approval. In addition, the demonstration effect of a successful experiment on the large landholder's farm is likely to have a significant positive effect on local, small farmers. Clearly, much time will pass before small farmers adopt a new practice. The project design should ensure that when they do begin to innovate, they will have all they need to do so effectively, including adequate information on procedures to follow.

A. Formal Leadership: The Union Councils

1. Formal leadership at the local level is vested in the union council system. Union councils represent the only electoral form of local leadership in rural areas.[3] Every two years, the village community--both men and women--elect a representative to the union council. The union council members elect a representative to serve on the Markaz council which, in turn, elects a member to serve on the district council. A group of district council leaders then elects a representative to serve on the division level council which answers to the provincial governor's office.

2. On the local level, a union council leader can lobby for various projects in his village. The Markaz council can allocate funds to villages for small development projects. It also provides approval and assistance to larger development projects such as paved roads or irrigation systems. In the villages, the union council leader can raise taxes through charges on festivities, marriages, roads, hearths (ovens) and

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[3]In some areas, the union council leaders are actually popularly elected. One such leader was encountered in Vehari. In other instances, the union council leader is the largest landowner or tribal leader who runs unopposed for the position. In both cases, the union council leader is likely to be a large landowner.

house construction. Generally, these taxes are only five to ten rupees per annum and are levied at the discretion of the union council leader.

3. By submitting proposals to the Markaz council, union council leaders can obtain funding for a variety of development projects. Special funds are made available to the councils through a provincial matching grants service to provide for the needs of development projects. These projects can include small road construction, irrigation canal rehabilitation, provision of health services, literacy training, independence day celebrations and nearly any other sort of project that can be justified under the heading of "village development." To carry out these projects, a proposal[4] is submitted to the district council. If approved and included as part of the next year's routine budget, it is funded automatically. Funds are provided for building materials, engineering assistance and any supplies needed to maintain the facility. On a self-help basis, the villagers are expected to supply the labor for the project.

4. Projects initiated and executed through the union council system are generally promoted by the individual initiative of a creative leader. In the Sind, we visited union council leaders who had done very little except obtain books for a primary school and had no plans for any activities for their villages. On the other hand, a union council leader with a certain amount of individual initiative can get roads, schools and dispensaries built in a fairly short time.[5]

For oilseeds projects, it would be useful to tap into the self-government system in selected subdistricts with active, progressive Markaz council leaders. These leaders could help promote new oilseed technology, establish assistance programs for livestock and aid in reviewing and evaluating on-farm projects.

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[4]Generally, the village must provide evidence of funding availability for half the project, the there are exceptions in certain cases. The government is favoring the selecting of certain types of projects by supplying a two to one matching grant, as in the case of canal desilting and reforestation.

[5]See the following section for a more detailed discussion of innovation landlords.

B. The Role of the Landlord in Community Improvement

1. The major landlord plays a key role in the development or non-development of areas under his control. In the worst case, he can seriously hinder all contacts between his tenants and outside agencies. On the other hand, a progressive landlord can secure many services for his tenants and share improved farming procedures with them. Examples of both cases were encountered during the field trip in the Punjab and Sind.[6] The effects of both types of landlords were significant and immediately visible in the area.

2. An innovative landlord in Vehari District, Punjab, had a very positive effect on his tenants. He helped arrange for road building, schools, irrigation canal cleaning,[7] industrial and literacy training for women. In addition, he read all of the Agriculture Department's fact sheets before each crop cycle and followed the recommendations. Other farmers were free to observe his farm practices and use of inputs, and follow his lead to improve their own fields. He hired women to pick cotton and arranged good payment terms.

3. Innovative landlords in the areas selected for oilseed projects should be identified and their cooperation sought. One landlord, like the one mentioned above, can be a more effective vehicle for the transmission of new farming ideas than the local extension field officer who is often without land and of low status in the community. This man's land (100 acres) and the fact that he was not very young made his voice respected in the community. He had been elected a union council official and worked without salary. Many social services such a women's industrial homes, clinics and sports facilities require a considerable amount of village level initiative for their attainment. The innovative landlord not only provided the initiative to organize and seek government assistance, but also used his influence to speed things through the bureaucracy.

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[6]Technically, Pakistan still has a ceiling on landholding size. There has been limited enforcement of the legislation since Bhutto's time and by registering land in the names of several family members, the legislation is easily skirted. Large landholdings of several hundred acres are more common in Sind and NWFP, but less so in the Punjab. Without further agrarian structural reform, it would be myopic to attempt to direct outreach services to small farmers without obtaining the consent of local landlords.

[7]His area had won a prize from the provincial government for the best maintained canals.

4. A backward type of landlord can similarly have a profound, but negative, effect on the development of his area. Such a landlord was encountered in Sind, north of Hyderabad. His family owned 1,000 acres, and his relatives owned all of the surrounding land "as far as the eye could see."

   His lands had seen few modern improvements. A primary school for boys was available, but he did not see any reason to have a school for girls.[8] He had no contact or interest in the agricultural extension service. His crops were poorly spaced and he did not believe in intercropping. About 25 percent of his land was waterlogged, but he was not interested in building tube wells unless the government came to install them at no expense. When he raised the share of the harvest to fifty-fifty with his tenants, he made them pay all the input costs.[9] In general, this landlord would much prefer to act as an autonomous tribal leader.[10] He resented the intrusion of government into his lands through law enforcement and revenue collection. Surprisingly, he nonetheless awaited government installation of tube wells.

5. Major landlords, innovative or not, cannot be overlooked in project design if the project is to succeed. It is not sufficient to select an area where soil, water and climate are adequate. Even the potential economic benefit to an area will not sell the project without the major landlord's cooperation. Where there are powerful landlords, tenant farmers cannot be approached directly with any success. It may also be difficult and time-consuming to get cooperation from the most backward landlords, even by approaching them directly. If benefits are to reach the tenant farmers, great care must be taken to win the landords. But landlords must not be ignored and their cooperation should be obtained before starting work in their area.

6. Working through these big landlords should not be seen as decreasing benefits to small farmers. Landlords are a reality of the rural social system. Their tenants

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[8]One of his sons who met with the team had an M.A. degree from the University of Karachi in a field unrelated to agriculture.

[9]The innovative landlord bore the cost of the inputs himself.

[10]At least one of this landlord's sons, armed with rifles, accompanied each team member on interviews.

often respect them; elders will listen to them, while an outsider working on the project may be distrusted. Tenants of a backward landlord may fear reprisals if they deal directly with outsiders. To reach these tenants, one must work through the landlords. Field work should also be done with the tenants, but only after the landlord has agreed.

V. RURAL AGRICULTURAL SUPPORT SERVICES

To promote the increase in domestic sufficiency of edible oilseeds, a significant share of project resources should be devoted to the development and dissemination of new oilseed technologies. This is justified by the low on-farm yields of the oilseeds to date. Pakistani oilseed yields can be compared with those obtained on average in North America to illustrate the size of the gap in oilseed technology.

Average Yield, 1978-1980 Average
(kgs/ha)

Crop	Pakistan	North America*
Rapeseed	583	1,148
Seed Cotton	962	1,360
Groundnuts	1,242	2,564
Soybean	483	1,979
Linseed	561	791
Sunflower	747	1,393

*For rapeseed, Canadian figures were used as a North American Proxy, while for the other commodities, U.S. figures were used as the North American measure.

Source: FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

For the major domestically produced edible oil sources--cottonseed and rapeseed--there is a 50 to 100 percent gap between the Pakistani and the North American yields. That yields are considerably higher in North America does not imply that a wholesale transfer of production techniques in an isolated fashion will provide an adequate and sustainable means of transferring technology. A wide range of support services for oilseed development must be encouraged, even nurtured at times, to guarantee the development of an atmosphere conducive to the widespread dissemination of new agricultural techniques.

Before discussing support services for oilseed technology, the experience of Pakistan in the introduction of high-yielding wheat varieties should be considered. The wheat campaign in Pakistan was, for the most part, responsible for a 40 percent increase in yields and a 20 percent increase in acreage of wheat from 1969-70 to 1981-82. This allowed Pakistan to move from a major domestic deficit position to one of slight surplus.[11]

There has been considerable debate over the merits of the wheat campaign, not on the production-gains side, but on the equity aspects and externalities resulting from the adoption of new technologies. While most of the conclusions about the spread of benefits from the wheat campaign are still openly debated, it is useful to review several of the major findings of the more equity-oriented studies.[12] From these studies, it seems clear that inequities in Pakistani society have been reinforced by the introduction of new technologies. According to an IBRD study,

> The evidence from Pakistan shows much more clearly that the gains from the new technologies and nutrients have gone disproportionately to larger farmers. Only a smattering of evidence exists to show that small farmers have adopted the new technologies.[13]

According to Gotsch, larger farmers were the first to learn about the new technologies because they had better access to extension and research institutions. They were able to use this knowledge productively because of their ability to obtain credit. This advantage in access to credit is supported by Lowdermilk's

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[11]Yield and area estimates from IBRD, Palistan Economic Development and Prospects, 14 April 1982.

[12]A wide variety of pieces have been written on the effect of the "green revolution" in Pakistan. For a good summary piece, see Inderjit Singh, Small Farmers and the Landless in South Asia, World Bank Staff Working Paper No. 320, February 1979. See also M. Naseem, "Mass Poverty in Pakistan: Some Preliminary Findings," Pakistan Development Review, Vol. XII, No. 4 (Winter 1973); and the set of articles in Rural Development in Bangladesh and Pakistan, eds. Stevens, Alavi and Bertocci, Honolulu: University of Hawaii Press, East-West Center, 1976. The Pakistan Development Review, Stanford University's Food Research Institute Studies and The Pakistan Economic and Social Review are all good sources for the review of the effect of green revolution techniques.

[13]For the IBRD source see Singh, *op. cit.*, and M.K. Lowdermilk, "Diffusion of Dwarf Wheat Production Technology in Pakistan's Punjab," Ph.D. dissertation, Cornell University, Ithaca, New York, May 1972.

research in the Punjab in which large landowners (over 50 acres) were twice as likely to have funds available for agricultural tasks than small holders (2.5 to 7.5 acres).

The institutional support-service bias in favor of larger landholders is a factor that will have to be addressed in the oilseeds promotional campaign as well. However, one of the biases from the wheat campaign that can be overcome for oilseeds is the irrigation bias. Early wheat intensification measures were concentrated through the Indus River basin to ensure proper water control for new varieties. These measures, however, widened the gulf between the large number of dry land (barani) farmers and those who had access to irrigated land. Since a large share of oilseed cultivation (excluding cotton) is on dry land or rainfed, irrigated land, technology diffusion measures should actually alleviate certain land-base biases.

Several precautionary measures must be considered when designing a production campaign for oilseeds to avoid promoting measures exacerbating rural inequity. These lessons, as drawn from field observation, can be grouped into three categories: research, extension and credit. (Marketing and pricing will be discussed in a later section.)

In general, the Pakistani farmer does not view oilseeds as substitutable commodities or, in many cases, as commercial commodities. Cotton and mustard are considered by the farm sector to be a cash and a staple crop--the former primarily for direct market sale and the latter for a wide range of household uses, including hair care.

The problems cited by farmers in raising the yields varied by crop. Farmers mentioned several constraints on oilseed crops. For three crops--mustard, cotton and soybean--farmers mentioned the following factors as contributors to low levels of production:[14]

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[14]Several farmers complained that oilseed crops were particularly sensitive to the vagaries of disease, pests and weather. For the smaller farmer, this added risk element often precluded the planting of oilseeds. Risk can be reduced through proper pest management, price stabilization measures and guaranteed markets. By reducing the yield risk, many of the new nontraditional oilseeds may become attractive crops to the more risk-averse small farmer. Access to credit and the ability to afford inputs would also improve the farmer's ability to bear risks.

Constraint	Mustard	Cotton	Soybean
Pests (worm, boarer, virus, rot, weevil, birds, rats)	x	x	x
Seed Quality (empty seedcoats)			x
Low Prices	x	x	x
Lack of Credit		x	
Lack of Market			x
Inadequate Processing Facilities	x		x
Unpalatable			x
Insufficient Labor		x	

*Based on field observation.

Hence, for different crops there are different constraints to higher yields. This is well known by the farm community and by GOP researchers, and has been taken into account in the preparation of an oilseed development project. The different constraints are understood at the farm sector and at the national provincial research institutes.

However, there is a mid-level gap in the formal information network that has inhibited the development and dissemination of new oilseed cultivation techniques. For example, the various provincial and district research centers evidently have access to improved seed varieties that are most easily adapted to the local surroundings. In addition, the Pakistan Agricultural Research Council (PARC) has produced documents indicating it is aware of the technical constraints to higher production of each oilseed crop and is conducting research to overcome them. At present, research station yields for cotton are estimated at nearly twice the level of those obtained on the progressive farmers' fields. Obviously, there is a gap between the activities of the research community and the technology available to the farmers.

Several factors can explain this gap. First, on the district level, contact between agricultural station researchers and the local extension community are infrequent. Rarely do researchers conduct field experiments on the farmers' own plots. At the stations visited, the most common attitude was that a full-control field station was the only appropriate place to conduct an experiment. A good degree of communication takes place between the research stations and the district extension service, providing recommendations for fertilizer, seed variety, pesticide, cultivation technique and so forth. Yet researchers conducted very little in-field follow-up activity on farmers' fields to investigate the fitness of their recommendations.

This tendency for a uni-directional flow of communication from top to bottom permeates the extension system as well. At present, there are really two formal extension systems operating for agricultural commodities. The traditional system is based on a provincially-centered extension bureaucracy with teams at

division, district and tehsil levels. The extension systems in the Punjab and Sind also have several districts using the extension training and visit system. Under this system, groups of contact farmers work in consultation with an extension agent (field assistant). The agent theoretically adheres to a tight schedule of visits and office periods and spends one day per fortnight in a training session. Under both systems, field assistants are required to set up demonstration plots, regularly distribute information and communicate with higher level extension agents, research officers and the farm community.

Generally, the extension agent and the field assistant are able to provide information about the major crops in a region. For most areas along the Indus basin, extension agents are able to supply information about wheat, sugar and cotton. In many cases, oilseeds account for only a small part of the extension agent's domain, so he tends to be overlooked in the hierarchy of official duties.

Farmers frequently complained that they had never been able to contact extension personnel, that demonstration plots were merely signs planted in a field and that the advice they had received was invalid. Since the responsibility for pesticide supplies had been returned to the private sector, farmers were also unable to obtain adequate information or materials (spray packs and chemicals) for pest control. While these problems apparently exist, extension agents are frequently handicapped by a lack of transportation facilities, low pay grades relative to educational achievement and negligible budgets.[18]

Besides formal contact with an extension agent, there are other mediums for the dissemination of agricultural information. In several areas, the extension service produces a daily radio show on agricultural practices. Likewise, agricultural practices are transmitted over the national television service. Radio shows, in particular, appear to reach a broad audience in the villages, but it is difficult to gauge the effectiveness of a message transmitted over the radio. Most farmers did not feel that it constituted "proof," but in combination with other forms of information transmitted, radio broadcasts do have the potential to reach the widest group of farmers.

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[18]It is difficult to tell if the T&V extension system will improve the flow of communication from the farm level up through the extension ranks. Preliminary observation indicates otherwise. In several areas, T&V agents complained that they were asked to do considerably more work than the traditional system agents without any change in pay scale. This seems to be a widespread complaint and one of the prime reasons why nearly a quarter of the 820 field assistant positions for the T&V program in the Punjab remain unfilled.

Agricultural slogans painted on rocks and the dissemination of agricultural fact sheets are additional ways in which messages are transmitted to the farm sector. In many cases, the production message does seem to reach the small farmer, but more through a trial and error process in which the achievements of a more progressive (or better connected) farmer are copied, questioned and adopted. The lag in this process can be as short as a few weeks to as long as several crop years.

In many instances, it is not the lack of knowledge that inhibits the smaller farmer from adopting the new techniques, but rather the lack of financial resources. In many cases, poorer farmers are required to borrow from village moneylenders, merchants and other elites at high, real-interest rates. Many poorer farmers, farm workers and tenants are obligated to a life of near economic enslavement[16] due to a cycle of debt and insufficient funds for repayment.

The government has provided a source of institutional credit through the Agricultural Cooperative Banks which have branches in the major district and subdistrict urban areas. In recent years, the banks have utilized employee credit-recruiters, or agents who go to the villages to encourage farmers to use institutional credit.

The most common formal-sector institutional credit for agriculture is granted through the cooperative society. To join a cooperative society, a group of farmers must have registration titles to the land checked and approved, and be authorized as a cooperative by a representative of a cooperative bank. Opinion varies widely, but apparently most farmers believe that a minimum holding of about 10 to 15 acres is required to join a cooperative.[17] After the cooperative society is recognized and registered, it is entitled to request, through a working committee, a loan of up to Rs 50,000 per season.

The working committee approaches the bank manager who, after providing forms to be filled in and approved, approves the credit. The working committee then receives the production inputs, certified seed and fertilizer at controlled rates and pay orders for the remainder. The pay order can be cashed or deposited in the cooperative's bank account. Credit is applied to delinquent loans. Frequently, an inspector, sub-inspector and a revenue official will visit the farmer to verify that the people in the society are landowners and cultivators and that they are using the loans for the purposes attested.

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[16]This was most apparent in the Sind, but less so in the Punjab.

[17]The use of a minimum holding and the requirement that the farmer own property effectively exclude the majority of rural cultivators from cooperative activity.

In the field, farmers generally complained of difficulty in gaining access to cooperatives, excessive corruption and problems in clearing paperwork to obtain loans.[10] In most cases, the most prosperous cooperative associations were among the large zamidar (landowners) who were able to afford the costs of accessing institutional credit. In Multan, a small landowner representing a cooperative of only small landowners spearheaded the formation of that cooperative in 1960 because he felt farmers had no other choice but to organize to better their lot. He called a meeting of the village elders, explained his ideas and spent several weeks in the city to arrange for group credit. A considerable amount of individual initiative is still required if small farmers are going to form and maintain successful cooperatives.

At the division level, there appeared to be almost no communication between the agricultural department and the cooperative bank. Agricultural officers stated the cooperative bank was supplying only a fraction of the credit needed for production so input-planning could proceed without them. One cooperative bank leader in Multan stated that financial allocation was based on provincial and district assessments of the credit capacity of his region, and not necessarily on the agricultural credit requirements of the farm population.

In general, cooperatives only serve the major food and cash crops. In areas where cotton production is heavy, cooperative banks do provide production loans for cotton. It is unlikely that loans are provided for the traditional oilseeds. For the newly introduced oilseed varieties--soybeans in particular--in-kind production loans are granted in exchange for seed as part of a Ghee Corporation seed stock production arrangement. Generally, farmers who were not cooperative members were reluctant to join cooperatives; instead, they felt there was little use in doing so. Although cooperative societies for production/credit purposes are active in some areas, there is very little sign of any cooperative marketing or processing of foodstuffs. In part, this is due to the nature of the traditional marketing system.

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[10]Farmers generally stated that one needed "proper connections" to obtain loans. No large landowner spoken to in the Punjab and the Sind had ever received a technically interest-free cooperative bank loan without paying a "facilitating charge" (bribe) that was less than ten percent of the value of the loan.

VI. MARKETING: THE STATE AND THE PRIVATE TRADER

The rural market serves as a medium for the transmission of commodities, but more important it reinforces organic links between the dominant mode of production and the wider extra-village community. For oilseeds, several markets operate simultaneously. To simplify matters, the oilseeds marketing sector will be divided into state and traditional channels. An example drawn from the Vehari District will illustrate the differences in each.

In Vehari, the Ghee Corporation supervised the processing of cotton for oil. Ginning mills were licensed by the Department of Industry and each mill was provided with a small log book for the ginners. They were required to list each purchase of cotton and record the quantity of seed produced. They were also required to sell the seed at a controlled price to local expeller plants and record transactions. At expeller plants, managers were required to crush and refine the oil for sale to the Ghee Corporation. Based on the amount of seed purchased, the expeller-owner was required to sell oil directly to the Ghee Corporation (GCP). A GCP truck would pick up the oil every other day and deliver a receipt to the expeller which was later used to obtain payment.

In this system, farmers brought their cotton directly to a ginner or to a wholesaler who would then sell to a ginner. These sales were almost all cash-and-carry, with only lots of a bag (about 50 kgs) allowed. At the ginning facory, the manager and the cultivator negotiate the weight and quality of the cotton. It was said that farmers would try to add rice straw or gravel to the bags to add weight. The ginning mills tend to underestimate their total purchases because the smaller lots (under 50 kgs) generally go unrecorded. In some cases, ginners provided farmers credit in exchange for output. This was said to be an infrequent practice, however, due to the competitiveness of the sector and the problems of assuring high-quality output.

A more serious constraint in this system was the pricing policy of the government. Expeller plants were required to sell their oil output to the GCP at the controlled price of Rs 250 per maund (40 kg, in this case) of refined oil. Out of a 40 kg maund of seed, the extractor would produce 4.5 kilos of refined oil (for the GCP), 33 kilos of feed cake, 1.5 kilos of oil dirt and 1 kilo of waste. The oil dirt sold for Rs 400 per drum (45 kilos) at free-market prices that were considerably higher than the price of refined oil. For the extractor, the aim was to produce as much oil dirt as possible without appearing to violate the GCP's procurement regulations. As a consequence, the extraction process is conducted at a low-pressure level, yielding a sizeable amount of oil dirt. By running the crushers at less than full pressure, an additional one to two percent of the oil also remains in the cake.

The state and the traditional[19] markets diverge in the degree to which marketing is integrated, on a person-to-person basis, with the spheres of rural production and consumption. For the state, the channels of integration between marketing and production are divided among various arms of the bureaucracy, credit banks, co-ops, extension agents and so forth. For the traditional marketers, these functions are somewhat more integrated through the medium of the marketplace.[20] This shall be illustrated with an example from the wholesale market in Vehari.

The traditional trade cycle begins before the crop season when a farmer or cultivator approaches a merchant and requests assistance (not credit) for the upcoming planting period. If the farmer is known by the marketer and considered reliable, cash is advanced. After the harvest, the farmer brings his produce or the portion he wishes to sell to the merchant's stall.[21] Each day, an auction is held to sell off the goods to the highest bidder in the market. If the price is acceptable to the farmer he can agree to the purchase; otherwise, he can refuse to sell at the bid price and return another day. The farmer leaves his goods with the merchant who guards them and, when sold, arranges for the collection of funds for the seller.

The auctioneer (dallal) receives .25 percent of the value of the sale as a commission. The arthi, for his cash advance and sales assistance efforts receives five percent of the value of the sale. This is not a usurious rate for the credit and services extended. In fact, it approaches the government-subsidized interest rates and includes sales services the government does not provide.

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[19]Traditional is used here in the sense of long-established. Traditional marketing channels do change and adapt to new circumstances. They should in no way be considered backward or inhibitive of technological innovation.

[20]It is not strictly true that GOP production, marketing and consumption are all channeled through separate agencies. In Swat, for example, GCP agents operate a seed turnaround program for soybeans in which farmers are provided seed and fertilizer and are required to sell their output, at a controlled price, to the GCP. This system has had some success in the Swat Valley, although farmers do complain of low prices, poorly timed input deliveries and, in one case, of the tendency for GCP agents to try to purchase the soybeans at less than the controlled rate.

[21]The wholesale market (mandi) is shaped like a horseshoe with, in this case, 42 shops built into the open ring. In front of each shop wares are displayed. Inside the shops are more wares, desk space and generally, locked godowns. In the center of the horseshoe were godowns and a ring of trucks, Suzuki vehicles and small herds of cattle, buffalo, goats and chickens. Each shop has at least one trader (arthi) but may be used for as many as four or five traders in partnership.

For the agricultural commodities, the arthi generally tries to buy at three to five rupees below the current retail price (per maund of 40 kg). Each shop is equipped with a telephone and, from observation, the trader keeps nearly constant contact with informants in bigger cities to monitor prices and competing markets. In addition to his role as purchaser of goods and provider of credit, the marketer also serves as a conduit to the major urban centers of the nation. Although technically prohibited from doing so, the arthi will sell large lots of sugar and cotton to markets as far away as Lahore and Karachi, depending on relative prices.

Long-distance sales serve two purposes. To society as a whole, they provide a means of spatial equalization of prices (spatial price differentials equated to a fixed percentage of transport costs). To the trader, long-distance transactions provide a means of combining a sale with a buying trip. In the urban area, the arthi purchases various consumer goods--worth nearly Rs 100,000 at a time--and ships them back on the same trucks that carried the agricultural commodity to the city. Part of the lot is sold to the town merchants, while the remainder is stored in the shop for retail sale and to replenish the shop's inventory.[22]

Although there is a great deal of price competition among the marketers, all are bound together formally by the dictates of the market committee. Each year, all of the businessmen elect five people to serve on the market committee. They, in turn, select a president. The president and the committee members then hire a staff of 15 to 20 people to maintain the market and conduct the auction. The president is also the final arbiter for any market disputes and supervises the commodity markets.

In general, the marketers are successful because they can integrate the credit, market disposal and long-distance trade functions. To the small farmer, the small-town arthi is a source of funds, a reliable market for his commodity and a source of much-desired consumer goods. Over the years, alliances are built up between farmers and the arthi. Because the farmer's goods are sold in a public auction, the arthi's and the farmer's interests are merged at the time of product disposal. Although the arthi functions inside the umbrella of the state marketing system, he is able to do so competitively to promote the building of long-term working ties with the farm community.

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[22]The marketer also serves as a conduit of urban tastes and values. The entry of infant foods, Coca-Cola and candy bars into the villages come through these channels. Marketing is also man's work. As one marketer suggested, "Islam would not look kindly upon a woman trader."

VII. THE DOMESTIC EXTRACTION OF OIL

There are three major types of expeller facilities used in the processing of edible oils.[23] The first of these is the kohlu, which is a mortar-and-pestle type of oxen or small motor-powered crusher. These are small, owner-operated facilities which can generally handle three to four maunds of seed (a 40 kg maund), at a charge of approximately one rupee per kilo processed. There are an estimated 15 to 20,000 kohlus in operation which provide a primary income source for more than 100,000 individuals. The kohlus primarily process rapeseed and mustard to be used for in-village consumption. In addition to the oil, they turn out a cake with a 15 to 16 percent oil content. The cake and oil are returned to the customer who either feeds the cake to his livestock or sells it.

In many parts of the country, the kohlus have been displaced by mechanical expellers. There are two types of mechanical expellers--high and low pressure--and only those that are equipped with steam units handle cottonseeds. The mechanical units, for small-lot jobs, were reported to charge 70 paise per kilo of seed, or 30 percent less than the traditional expellers. The mechanical expellers are also able to extract two to three percent more oil than the kohlus. An average, low-pressure mechanical expeller can process as much as 200 times that of the animal-powered kohlus.

The third form of extractor is the solvent unit. There are at present 15 solvent plants in the nation. These are operating at only 11 percent of installed capacity. At full capacity, these plants could process all of the oilseeds produced in Pakistan. The solvent extractors are also the most efficient form of processor, recovering 95 to 98 percent of the oil from the oilseed.[24]

The major trade-off between these three forms of extraction facilities is between efficiency and employment. The oil processing sector is one of the largest of the agro-based industries. A study on the processing sector found that, "In 1975/1976, the oil milling sector employed 27,238 people and generated a value-added of Rs 1,005,179 thousand (in 1960 prices)." That same study concludes that kohlus and mechanical extraction facilities are preferable to solvent plants because of (1) the lower installation costs, (2) lower operating expenses, (3) flexibility in amount processed, (4) good contact with the

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[23]In this section, the issue of ghee plants is not being discussed. The hydrogenation plants are being returned to the private sector, although there have been considerable delays in the transfer of ownership.

[24]See Pakistan Agricultural Research Council, Perspective of Edible Oils Research and Production in Pakistan, Islamabad, 1981.

local market and (5) production of the preferred form of feed (high fat oilcake).[23]

There are other factors besides the efficiency/employment trade-off that should be considered in the design of assistance programs for the extraction sector. First, the kohlus as a traditional means of processing are embedded deeply within the various caste systems of Pakistan society. With the caste, one's social status and profession are directly linked. Thus, for a kohlu owner to become, for example, a shopkeeper, would require a change in skills, property and status--the last of which is perhaps the most difficult to achieve in a single generation.[24] Also, because the kohlus operators process very small lots of oilseed, their displacement may force the small subsistence-based oilseed cultivator out of production or into a form of larger-scale commercial cultivation.

Aside from the efficiency argument, there are several reasons why the mechnical expeller sector should be assisted by an edible oilseeds project. First, in certain areas kohlus and mechanical processors are handling different products and are not in direct competition. Where mechanical crushers do not exist, the limited load that can be absorbed by the kohlus may be a disincentive to the higher production of edible oils.

The building of mechanical expeller units is reported as one of the more common productive investment outlets for overseas remittances in recent years. The start-up costs for a small crusher facility with a 500 maund (40 kg/md) capacity is 10 lakh rupees for building and equipment. In a case in the Punjab it was two lakh for two acres of peri-urban land. In the cotton belt of the Punjab, the crushers operate seasonally, running at almost full capacity for four months of the year. To operate the plant requires a running capital of nearly 30 lakh rupees per year to meet purchase obligations, salaries, repairs and other variable costs. For a laborer returning from the Middle East with a

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[23]See Sohail J. Malik, "A Note on the Edible Oil Milling Sector Output, Value-Added and Employment," The Pakistan Development Review, Vol. XVI, (Winter 1977).

[24]Caste barriers are rapidly being broken down by the diffusion of commercial farming practices in the countryside and by the returns from the Middle East employment market. These factors have enabled a short-term leap in wealth for many rural families.

savings of 10 to 15,000 dollars, an investment in an extraction facility is a financially attractive option.[27]

Where the use of mechanical expellers would enlarge the market for edible oils, improve processing efficiency and provide a productive use for overseas remittances, it is suggested that they be technically and financially supported by assistance from an edible oilseed project. Furthermore, if these units can be vertically integrated with commercial livestock operations, it will also improve the pricing and production incentives atmosphere for the farm sector. For the small kohlu operator, some attention should be given to improving production efficiency, although it is suggested that a more profitable form of project activity would be in the identification of alternative employment opportunities.[28]

VIII. REACHING RURAL WOMEN

A. Women in Villages

1. Despite some regional or seasonal variations in activities, a village woman's day varied little from NWFP to Sind. Caring for her family and home is a village woman's primary, and usually sole, activity. Having a wealthy husband could mean that a woman has less personal involvement in houshold chores, thanks to servants. It did not mean that she was free to use her leisure time to engage in activities outside the family compound such as school or work.

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[27]In several cases, owners claimed that they were able to recover the fixed costs of their investment in a two to three-year period. One owner did complain that delays in obtaining licensing for the plant contributed to higher start-up costs. All extraction plants are registered with the Department of Industry. Although the official registration fee is quite small, private sources estimate that a payment of nearly Rs 25,000 is required to facilitate the authorization of a new factory.

[28]In recent years, there have been several studies on improving the efficiency of the small-scale kohlus. A set of training manuals for the improvement of this form of expeller is available from the Appropriate Technology Institute in Lahore. From a donor-financed study, there is Village Level Oilseed Processing, Final Report, University of Denver, 28 June 1980. Although there are techniques available to improve the efficiency of the kohlus, the economics of the operation dictate against their adoption. Kohlus owners charged a flat fee per kilo of seed milled regardless of the oil extraction rate.

2. Links between the women and formal institutions were few. When schools were available for girls, mainly primary schools, some did attend. Generally, it was felt that school for girls was fine until puberty as long as they were located nearby. In some cases, women said that their daughters could not go to school because they needed their help at home, mainly with caring for smaller children. When the men had had some schooling, it seemed to make them more interested in educating their daughters, at least through primary school. Industrial training homes in some villages provide opportunities for girls to learn crafts which they can make at home and sell if they wish.[29]

   Most women had been to a clinic at one time or another--often with a sick child--but the lack of female doctors severely limits their access to good medical care for themselves. Also, many women were unable to purchase the medications prescribed due to lack of cash. Other services such as agricultural extension make no effort to reach women, even where they are involved in agricultural work. Only female extension agents could assist women and none were available. It could be difficult to recruit women as extension agents since the position requires travel over a wide area. A restructuring of the role of the field agent for women would probably be required if a women's program were developed.

3. Seclusion of women in the Islamic tradition was observed to a greater or lesser extent in all three provinces visited. In general, it was considered to be the most desirable situation, but it was not always possible due to economic constraints.

   Women in NWFP, except for the poorest, did not work in the fields at any time of the year. Some women interviewed claimed not to have been out of their compounds for years.[30] They spent their days cooking, cleaning and caring for children and animals--buffaloes mainly--inside their compound. They did cleaning and storage of wheat after it was brought from the fields by their men. In this province, women never went to the bazaar to purchase food, household items or clothing, even for themselves. They had little idea of what could be found in the markets or of market prices.

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[29]Industrial homes are discussed in more detail below.

[30]It should be noted that these women were happy and appeared to be proud that they never went out.

In the Punjab, more women were found who worked in the fields, although there were regional differences. In Gujarat, men and women appeared to be mixing freely at a village home on a social occasion. Although none of the village women worked in the fields at any season, they were responsible for purchasing some items available in the village. The mother appears to be a key figure in this household and was given a central position, while her husband stood on the sidelines. Further south in the Punjab, it was very common to find women working in the fields, expecially at the cotton harvest.

In Sind, access was not generally provided to women in landlords' housholds. Although tenant farmers' wives worked in the fields (side-by-side with their husbands, they claimed), the wives of wealthier landlords were kept very isolated. An individual with an M.A. degree was found to have seven sisters and four wives who had never been to school.[31]

4. Marriages were arranged by families. Girls are a liability to a family because they must bring a very substantial dowry when they marry, while boys contribute nothing. A girl who cannot provide an adequate dowry is at a great disadvantage in selecting a husband. Age at marriage varied, but it seemed to be from early to mid-teens. The youngest located was espoused at nine to a landowner's son 14 years her senior. The marriage was consummated at puberty and she bore her first child at 14.

   After marriage, a woman generally goes to live in her mother-in-law's house and further ties to her own family become very weak. There is great pressure on a newly married woman to bear a child, preferably a son, very quickly. One girl of 15, married for three years with no children, was in desperate fear of losing her position in the household if she could not conceive soon. Perhaps the greatest power a woman ever wields is that over her daughters-in-law.

5. Differentiation of sex roles begins early in life. Children of both sexes can be seen working in the fields or playing freely in the village until the age of four or five. At that age, girls are likely to be brought into the compound to share in the women's tasks, especially to care for their younger brothers and sisters. Boys continue to work in the fields and, as they grow up, gradually take on the responsibilities

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[31]The profound effects of innovative versus backward landlords are discussed elsewhere.

of adult males. Often boys begin primary school at five or six. Less often, girls will also attend school until puberty if a school for girls is available. Some boys are apprenticed to traders or artisans--usually relatives--at age 10 to 12.

6. Income-producing activities for women in the villages observed were very limited. Although women were found to help with sowing, cultivation and/or harvesting in some areas, their husbands marketed the products. No portion of the money received was routinely allotted to the woman for her use. In Vehari District, Punjab, women were found to be working for pay by harvesting the landlord's cotton crop. This was the only case where women actually received cash payment for agricultural labor.

   The only other mention of income for women was through the industrial homes. There, women could learn to embroider or sew, and if they wished, sell their products. However, most women said they were only interested in making items for their dowries or for their families' use if they were married. A 1976 study in the Punjab[32] found that most women thought that people who sold their skill were low caste.

7. Although the above attitudes must be taken into account, income-producing activities that do not violate local custom too radically might well be attractive to certain groups of women. An environment that is all female, including supervisors, physically protected from the eyes of men, and offering locally-respectable types of work could be of interest.

   If an oilseed project has any components which meet the criteria, women might be considered for certain kinds of work. Before a detailed plan to involve women could be developed, further information is required on the design and particularly on the selection of sites for such a project. Because attitudes on acceptable behavior and seclusion of women vary from place to place, it is not possible at this point to give specific recommendations on women's roles in oilseeds projects. Given the restrictions on women's behavior, they are not likely to be very actively involved in oilseed production or processing. At present, it appears that an oilseed project will not have a significant effect, either positive or negative, on village women.

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[32]Seemin Anwar and Faiz Bilquees, "The Attitudes, Environment and Activities of Rural Women: A Case Study of Jhok Sayal," Research Report No. 98, PIDE, Islamabad.

8. Currently, the preferred cooking medium in rural areas is ghee made from buffalo milk. However, this product is generally available only to wealthier members of village society. The most frequently used cooking medium in all parts of the country visited is hydrogenated vegetable oil, commonly called Dalda (a brand name). In most places, liquid vegetable oil was unknown to the housewife. The few who had heard of it suspected it was not good for their health.

B. Formal Institutions and Village Women

1. Women's direct links to Pakistan's formal institutions are limited both by purdah (seclusion of women) and by the availability of services addressing women's needs. Although the links are very tenuous and often inadequate, they are already part of the country's administrative structure and would not require the development of new institutions. Two principal institutions will be considered: the women's industrial training homes, sponsored by the provincial Social Welfare Departments, and schools.

2. The village women's industrial homes (VWIH) involve a complex process of interaction between men, village voluntary associations, the social welfare bureaucracies and ultimately, women. Since similar processes lead to obtaining other types of improvements for villages such as schools, roads, etc., the VWIH process will be discussed in detail. The discussion of the VWIH should provide information on one of the few institutions reaching through the national, provincial and local government levels to village women, and on the process of local initiative community development.[55]

3. The process of setting up a VWIH begins in the village. It is up to local leaders to organize themselves into a voluntary association which then seeks registration with the Social Welfare Department (SWD). Before there can be a voluntary association, usually made up entirely of men, the men of the village must know that the VWIH program exists and must want to have such an activity for their women. Although the SWD is said to have some outreach workers who publicize potential services such as VWIH, clinics and sports facilities

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[55]The case study on which this description is based is taken from Punjab Province. Local level details were obtained at Gaggoo and a nearby village. Other data were obtained in Faisalabad and Lahore.

it is more likely that the idea reaches the village through someone who has direct exposure to such a facility elsewhere. This person may often be the innovative landlord leader described elsewhere in the report.[34]

4. The process of registering a voluntary agency at the SWD is complex and time consuming. Theoretically, it should take less than two months, but delays of up to a year are not uncommon. Approval has to pass through several levels of bureaucracy, providing many opportunities for favoritism and gratuities. Officially, the criteria for evaluating an application for registration are that (1) there must be no competing voluntary agency in the same area; and (2) the agency must be democratic and devoted to the welfare of all villagers and not just for the personal gain of a few individuals. On-site inspection takes place. Once a village voluntary association has registered with the SWD, it can apply for a variety of programs including VWIH, widows' homes (for training destitute widows), clinics or dispensaries, sports facilities and adult literacy programs.

5. To actually establish a VWIH, a registered village voluntary association must raise funds to provide land, a building and basic furniture for a school. Then it applies to the SWD for equipment and a teacher's salary. Applications are processed and evaluated at various levels[35] and finally submitted to the Social Services Board at Lahore for funding. The board meets once a year to allocate funds. The annual stipend ranges from Rs 3,000 to Rs 10,000. VWIH teachers are paid Rs 3,000 per year or Rs 250 per month.

   When a VWIH is first set up, it is given equipment such as knitting and sewing machines by the SWD. In subsequent years, it may not receive an allocation for the teacher's salary. Operating expenses are paid by the village. If a school is not well-run or managed, the equipment can be moved to another village.

6. Working VWIHs seem to provide a very useful service for women or girls who attend. They also reach some village women who do not attend officially, but who drop by to visit. They teach women embroidery, knitting,

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[34]This person often strengthens his influence by obtaining additional services for his area, including industrial houses.

[35]One innovative landlord mentioned that he had used his influence to speed his village's application along.

sewing and other handicrafts. Outside critics might argue that such tasks do not advance a women's position in society, but that appears to be untrue in this case. For a woman the VWIH can provide her only contact outside her home, an initial link to the larger social system of Pakistan, the chance to learn a marketable skill and a chance to hear and talk about some new ideas. Most interviews were conducted at industrial homes in NWFP and Punjab. The students expressed satisfaction at having the opportunity to learn how to do better quality work.

7. Potential income did not appear to be the main reason for attendance at the schools. Most of the girls interviewed said they were only learning the skills to prepare their dowry. A few said they might make some things to sell to neighbors. Oddly enough, when men were asked about the purpose of VWIH, they generally indicated that it was to enable the women to earn some money.

8. Industrial homes in cities seem to be more oriented to generating a source of income for their graduates. They teach the same skills but seem to have more and better teachers. Graduates come to them for work assignments which they carry out at home. The school takes a commission (25 percent at an APWA school in Lahore) and pays the women the rest.

9. Coverage for the VWIH is very limited. One SWD zone consisted of 220 sq miles, with a population of 65,972 in a town and 21 villages. There were five industrial homes in this zone, one in town and four in villages. Thirty-six diplomas had been awarded in the four or five years they had been there. One VWIH had 18 students registered. At night, the teacher taught a basic literacy course to 14 women.

10. Primary schools are another way of reaching village girls and women. Again, attendance is low. While village boys are occasionally sent some distance away to school, girls either attend school in the village or do not go at all. At present, the academic curriculum is the same for girls as for boys, but boys are given additional work in agriculture while girls do home economics.

11. The potential advantage to VWIH and schools is that they are already located in villages and provide a means of transmission of information to women. A school program in home economics could, for exmaple, teach the techniques of cooking with liquid vegetable oil and its nutritional advantages. The VWIH could also serve as a vehicle for transmitting information,

either informally or formally, through classes to women. Although only a few girls or women are in school or in the VWIH, they will pass on the information to their relatives and neighbors.

12. Radio does not appear to be an effective medium for transmitting new skills to women. As with men, the women prefer to see something demonstrated, otherwise they distrust the information. Where women work in the fields, potentially useful information could be obtained from the radio extension program, but women do not listen to it.

13. Health centers or dispensaries are also visited by women from time to time. They do not appear to have the sort of demonstration/teaching environment found in schools and VWIH, and women do not attend them on a regular basis. Many people said that such services were of limited use since the prescriptions were too expensive to buy. Only information not requiring repetition or extensive demonstration might be transmitted through such facilities.

14. No other formal institutions appeared to reach village women. Markets of bazaars could be used for cooking oil demonstrations, but only in the few cases where women frequently go to the market. Cooking demonstrations in bazaars frequented only by men would be of little use.

IX. PROJECT BENEFICIARIES

At this time, it is not possible to firmly identify project beneficiaries because project sites and activities have not been identified. However, the nature of this program, as an integrated commodity study, suggests that activities will include a wide range of production campaigns, marketing programs, diversification efforts, technical assistance and policy analysis/promotion. A number of client groups can expect to benefit from these measures.

An increase in domestic edible oil production would, in opportunity cost terms, result in a domestic savings of foreign exchange which would be, by itself, in the public interest. Through a program to increase the production of a segment of the farm sector that produces on marginal and submarginal lands, an inequity that has been exacerbated by years of government bias and neglect would be redressed indirectly. In a more general sense, the production increases will lead to an increase in income for oilseed farmers. For many years, these farmers were handicapped by the price ceiling on cotton and on ghee, which kept vegetable oil prices below world market levels.

For small farmers, an improvement in access to credit, inputs and extension will have a lasting institutional return beyond the scope of the project itself. For marketers, an improvement in processing efficiency and the return of control of the ghee factories to the private sector would provide an incentive for greater domestic investment, and perhaps more productive use of foreign remittances.

For the nation as a whole, self-sufficiency in domestic edible oil production remains a distant aim. However, a reduction in dependence on the international market for an internal necessity carries a certain intangible amount of security and project benefit. Finally, because the project can link livestock production efforts with feed and edible oil efforts, a commercial sector could be created, or at least integrated, from fairly diffuse, locally organized production activities.

Participants such as researchers and extension agents should also benefit from the project. It is hoped that the knowledge and experience they will gain (and transmit) from working with counterpart staff can provide a base for a self-sustaining GOP campaign in the edible oilseeds sector.

In the final analysis, the project is only of value if it transmits benefits to households--both men and women--in one form or another. In certain cases, there will be an income benefit and in others a savings from improved extraction facilities. By increasing domestic production, rural women, for example, will be assured a continual supply of a basic necessity at reasonable prices in the marketplace. Where project activities contribute to an introduction of new cooking or feed medium, or to an improvement in the quality of the cooking oil used in the household, health and nutrition benefits will accrue that are fairly intangible, but still important.

X. MONITORING AND EVALUATION

Monitoring and evaluation procedures are neutral tools that can be used to improve the design and execution of an edible oilseeds project. All too often, the best laid development plans go to naught due to problems in project implementation. Pakistan is no exception, as is testified to in the national political arena by the gap between the stated aims and objectives of the national five-year plans and the results of various development schemes. Difficulties in project implementation must be expected and capabilities developed by the administrators of the larger project staff to identify and overcome the constraints to proper project implementation. Consequently, data should be gathered during the course of the project and appropriate design or procedural modifications discussed and implemented.

A strong commitment to monitoring and evaluation is expected as part of an oilseeds development project. Social sector monitoring and evaluation can be used to improve internal project management and to assess the degree to which a project meets its stated aims and objectives.

One of the lessons of development projects in Pakistan, as well as in other parts of the world, is that a great deal of attention must be paid to problems of corruption and fraud. These must not be treated simply as "problems" but causes for such behavior as greed, low salaries and poor accounting and institutional adjustments. In addition, in normal project management procedures, special attention should be granted to the institutional issues of manpower shortages, absorbtive capacity of counterpart agencies, skills and training needs and the incentive structure for performing tasks that would customarily be outside of standard work requirements.

Finally, it would also be useful to assess the extent of interdisciplinary cooperation and involvement at various stages of a project. The reasons for or against cooperation by project participants should be noted and measures taken to improve interdepartmental communication and coordination.

Many socio-economic effects will result from an edible oilseeds project; these effects will be specific, directly affect the project's success and require close monitoring. In the earliest stage of a project, baseline surveys or secondary data collection should be carried out in the project area to provide a measure for later evaluation of project effects.[34]

During project implementation, various kinds of anticipated or unanticipated socio-economic effects should be monitored, and where appropriate, the project design modified to mitigate negative effects. Questions to consider are:

a. Has access credit or agricultural extension changed during the project?

b. What new crops or techniques have been adopted by farmers and what were their experiences with them? Were they profitable? What problems occurred? Could farmers resolve the problems?

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[34]The data discussed in this report should provide a guide to the topics to be covered in the baseline study. The baseline study (or studies) will require a more extensive and more rigorous analysis of the specific sites selected for project implementation, e.g., selection of a representative sample. Baseline data collection is crucial to the process of monitoring the socio-economic effects.

c. How did farmers who adopted new techniques or crops find out about them? What led them to make the change?

d. What factors led farmers who began commercial oilseed production to make the change? What kinds of farmers made the change (size of holdings, cash, debt position, etc.)?

e. Are state marketing procedures compatible or competitive with the private sector?

f. Is there any employment displacement attributable to the project? For example, are traditional oil expellers being driven out of business?

g. Does government pricing policy allow a reasonable return for oilseed marketing (and production)? Are the benefits the same for small as for large farmers?

h. Are households increasing their consumption of liquid cooking oil? What factors have influenced the change or lack of change? What role have women played in the decision?

i. Are the publicity campaigns promoting liquid cooking oil reaching their intended audience? Which publicity methods are most effective? Which publicity methods reach women?

j. To what extent are local landlords or political figures cooperating with the project? Identify problem locations for special attention.

THE PAKISTANI OILSEEDS SECTOR: AN INTERNATIONAL PERSPECTIVE

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In this section, the Pakistani oilseeds sector shall be compared to that of other nations. Comparisons across countries are dangerous because of variation in resource endowment, cultural practices and the historical experiences that shape a nation's ability to produce foodstuffs. Nonetheless, cross-country comparisons do have a value in their own right. They provide a means of comparing production performance on a country-relative basis. By doing so, conclusions about the gap between production in one nation and that which has been reached in a "similar" nation can be drawn. In addition, by drawing on the experiences of nations in various stages of socio-economic development, future trends in a particular sector can be derived. Therefore, international comparisons will be used to examine production performance, consumption trends and import dependence.

Table 1 provides a comparison of production, yield and area harvest for several of the main Pakistani crops with regional and

Table 1

An International Comparison of Yield, Area Harvested and Production of Rice, Wheat and Sugarcane 1978-1979 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Rice			
Pakistan	2,508	1,975	4,953
U.S.	5,140	1,206	6,199
Asia	2,646	130,564	345,491
World	2,615	145,268	379,814
Wheat			
Pakistan	1,485	6,696	9,944
U.S.	2,301	25,333	58,289
Asia	1,500	90,251	135,333
World	1,782	238,723	425,478
Sugarcane			
Pakistan	37,169	738	27,736
U.S.	84,552	297	25,112
Asia	49,825	5,811	289,532
World	56,040	13,457	754,130

Source: Ahmad M. Khalid, Pakistan: Agricultural Data Book, Agriculture and Rural Development Mission, USAID, June 1982.

world levels. As can be seen, Pakistan's wheat and rice yields are roughly 95 percent of the Asian average and are relatively close to world average levels. For sugarcane, Pakistan's yields fall well below the Asian averages, which are themselves only 88 percent of the world average. For example, Pakistan has nearly 2-1/2 times the area the U.S. has in sugarcane, but only receives 10 percent more output. The cross-country low-yield pattern apparent in sugarcane also occurs in many of the oilseeds.

In Tables 2 through 7, a comparison of yield, production and area harvested figures for several of the oilseeds crops--namely, sunflower seed, rapeseed, soybean, linseed and seed cotton--are presented. Table 2 shows sunflower yields are only 68 percent of the all-Asia average, which is 87 percent of the average among the developed nations. At present, Pakistan produces sunflower on a very small scale--under 1,000 hectares are in production.

Table 2

An International Comparison of Yield, Area Harvested and Production of Sunflower Seed
1978 to 1980 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Pakistan	747	*	*
China	988	425	432
Turkey	1,252	458	575
All Asia	1,088	987	1,081
South Africa	1,070	347	368
Canada	1,296	129	168
U.S.	1,393	1,612	2,256
Argentina	862	1,819	1,560
Romania	1,639	513	840
USSR	1,144	4,490	5,132
Developed Nations	1,237	8,833	10,934
Developing Nations	917	3,173	2,906

*Not listed in FAO accounts.

Source: FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

For rapeseed (Table 3), the situation is somewhat brighter. Yields are slightly above the all-Asia average. Relative to those achieved on average in the developed nations, however, they are still very low. Paksitan produces approximately 580 kilograms of rapeseed per hectare, while France can produce nearly 2,400 kilograms. Of the Pakistani oilseeds, rapeseed and mustard seed are produced on a fairly large scale. On the average, from 1978 to 1980, Pakistan produced 244,000 tons of rapeseed. While large by Pakistani standards, this yield still only accounts for two percent of total world production.

Table 3

An International Comparison of Yield, Area Harvested and Production of Rapeseed
1978 to 1980 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Pakistan	583	418	244
Bangladesh	649	211	137
China	647	3,420	2,221
India	467	3,539	1,653
Japan	1,762	3	5
All Asia	565	7,621	4,310
Canada	1,148	2,771	3,138
France	2,394	304	745
Poland	1,706	279	496
Developed Nations	1,492	4,178	6,163
Developing Nations	568	7,737	4,403

Source: FOA, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

Soybeans are a relatively new crop in Pakistan. As seen in Table 4, Pakistani soybean yields are by far the lowest in Asia, only 46 percent of the all-Asia average. Soybeans are produced on a small scale, with only 33,000 hectares in production.

Linseed is another small in-area crop, but one in which yields are fairly high. Pakistan's linseed yields are nearly twice the all-Asia average, which is itself drawn down by the very low linseed yields in India. At 561 kilograms per hectare, Pakistan's yields are about nine percent above the average for the developed nations. Although yields are fairly good for

linseed, Pakistan only produces 6,000 tons, or only two percent of total world production (see Table 5).

Table 4

An International Comparison of Yield, Area Harvested and Production of Soybeans 1978 to 1980 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Pakistan	483	3.3	1.6
China	1,059	9,155	9,699
India	916	297	273
Indonesia	826	766	632
Japan	1,479	129	191
Korea (Rep.)	1,168	218	255
Thailand	862	140	122
Turkey	998	3	3
Vietnam	1,570	44	23
All Asia	1,045	11,166	11,670
U.S.	1,979	27,260	54,012
Canada	2,231	283	634
Romania	1,103	289	314
USSR	624	843	524
Brazil	1,394	8,293	11,643
Developed Nations	1,928	29,053	56,075
Developing Nations	1,263	21,946	27,809

Source: FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

Peanuts have the potential to be used as an oilseed in Pakistan, although they are presently produced for use in direct human consumption. In Table 6, yields, area and production are listed for groundnuts. Pakistan's yields for groundnuts are well above the Asian average and the average for all developing countries, but are only half of that produced by the United States. Furthermore, groundnuts are produced on a very small scale in Pakistan, using only 38,000 hectares and accounting for well under one percent of world production.

Table 5

An International Comparison of Yield, Area Harvested and Production of Linseed
1978 to 1980 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Pakistan	561	11	6
India	227	1,892	437
All Asia	256	2,072	536
U.S.	791	305	243
Canada	923	677	617
Argentina	806	840	671
USSR	209	1,225	255
Developed Nations	517	2,506	1,302
Developing Nations	428	3,075	1,317

Source: FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

Table 6

An International Comparison of Yield, Area Harvested and Production of Groundnuts
1978 to 1980 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Pakistan	1,242	38	47
Burma	829	537	445
China	1,160	2,598	3,023
India	832	7,428	6,186
Indonesia	1,482	495	734
Thailand	1,129	108	122
All Asia	951	11,504	10,948
U.S.	2,564	598	1,545
Brazil	1,480	283	421
Developed Nations	2,173	919	1,994
Developing Nations	905	18,502	16,741

Source: FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

Seed cotton provides the largest source of domestically produced edible oil in Pakistan, although it is produced primarily for fiber, with oil as a by-product. Pakistan's yield of seed cotton is approximately 960 kilograms per hectare, which is nearly average for the developing world as a whole (see Table 7). In comparison to some of its Asian neighbors, Pakistan's cotton yields are fairly low. Both Turkey and Syria, for example, produce nearly two tons per hectare, while the People's Republic of China produces over four tons per hectare.

Table 7

An International Comparison of Yield, Area Harvested and Production of Seed Cotton 1978 to 1980 Average

Region (nation)	Yield (kg/ha)	Area Harvested (1,000 ha)	Production (1,000 MT)
Pakistan	962	1,968	1,895
China	4,683	1,509	7,081
India	528	7,666	4,050
Israel	2,203	156	345
Turkey	1,924	647	1,243
All Asia	972	15,883	15,453
U.S.	1,360	5,155	7,013
Egypt	2,536	508	1,290
Brazil	834	2,063	1,723
USSR	2,986	3,081	9,206
Developed Nations	1,981	8,701	17,251
Developing Nations	996	23,824	23,720

Source: FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

Several general conclusions can be drawn from this brief review of cross-country production performance statistics. First, with the exception of linseed, Pakistan's oilseed yields are low by the already low levels of the developing world. For certain oilseeds such as sunflower and soybeans, the gap between Pakistan's yields and those on average in the developed nations is over 50 percent. Second, with the exception of cotton, Pakistani oilseed production accounts for an almost insignificant share of world production.

Similar international comparisons can be used to examine consumption of oilseeds. In Table 8, a cross-country comparison of fat consumption, both total and from vegetable sources, against per capita income is presented. In 1979 terms, Pakistan's income fell near the bottom of the international income ladder at 290 dollars per capita. As the table shows, there is a general tendency for fat consumption to rise as incomes increase and for the proportion of fat derived from vegetable sources to decline as well. In Pakistan's case, fat consumption is at 42 grams per person, which reflects the preference accorded to fat consumption in the Asian diet.

What is surprising is the low proportion of fat from vegetable sources. Only 60 percent of the total fat consumption in Pakistan is from vegetable sources, while in Sri Lanka, a nation at a similar per capita income level, vegetable sources account for over 90 percent of total fat supply. This reflects, in part, the inability of the Pakistani oilseeds sector to provide the population with an adequate supply of low-cost vegetable fat.

Another conclusion that can be reached from Table 8 is that there is considerable room for an increase in domestic fat consumption as incomes increase. At present, Pakistan's fat consumption levels are less than a third of those in Sweden and are under half the level of Argentina. Given the preference expressed by the Pakistani population for a diet consisting largely of grains and edible oils, one can forecast a considerable expansion in domestic vegetable oil demand as incomes rise.

A large part of Pakistan's vegetable oil consumption is provided by imports. In 1981, imports of vegetable oil accounted for nearly two-thirds of domestic consumption. These come almost entirely from two sources--soybean and palm oil. In Table 9, the average quantity and value of soybean oil and palm oil imports for various nations are listed. In Asia, Pakistan's vegetable oil imports are second only to those of India. On average, from 1977 to 1979, Pakistan imported over 310,000 tons of vegetable oil at a cost of nearly 200 million dollars per year. Pakistan accounts for nearly seven percent of all world soybean imports and the same percentage of world palm oil trade.

The large and rapidly increasing imports of vegetable oil can be traced back to the twin causes of an expanding domestic demand as incomes have grown and to the low yields of the domestically produced crop. These factors will be described in more detail in later sections of this report. The examination of cross-country comparisons does suggest that there is a considerable yield-gap in domestic production. Furthermore, as reflected in the large imports, domestic demand far surpassed domestic production and has the potential to widen even more as incomes increase.

Table 8

An International Comparison of GNP Per Capita and Average Daily Fat Consumption

Nation	GNP/Capita (Dollars 1979)	Daily Fat Consumption* (grams)	Vegetable Fat Consumption (grams)
Bangladesh	90	13.6	9.9
Nepal	130	26.6	17.0
India	190	29.6	23.4
Sri Lanka	230	44.7	41.2
Sierra Leone	250	53.8	51.0
Pakistan	260	41.9	25.1
Tanzania	260	32.8	21.9
Madagascar	290	27.2	15.7
Mauritania	320	51.2	17.5
Indonesia	370	34.5	32.4
Liberia	500	53.9	48.1
Thailand	590	23.0	14.5
Philippines	600	30.1	18.5
Nigeria	670	49.8	45.1
Guatemala	990	38.9	26.6
Korea, Dem. Rep.	1,130	26.4	16.9
Turkey	1.330	62.1	42.0
Malaysia	1,370	44.1	29.2
Korea, Rep. of	1,480	31.0	16.5
Brazil	1,780	51.0	21.0
Argentina	2,767	118.3	42.1
Hong Kong	3,760	102.9	47.3
Singapore	3,830	77.9	32.7
Greece	3,960	138.6	81.3
Italy	5,250	130.7	48.5
United Kingdom	6,320	146.1	45.8
France	9,950	149.7	81.9
Norway	10,700	142.8	49.5
Sweden	11,930	141.3	49.4

*Consumption is an average 1977 to 1979 per capita estimate derived from food balance sheets.

Source: Income data from IBRD, World Development Report 1981, Washington, D.C., August 1981. Food consumption data from FAO, FAO Production Yearbook 1980, Vol. 34, Rome, 1981.

Table 9

Quantity and Value of Soybean Oil and Palm Oil Imports
for Selected Nations
1977 to 1979 Average

Nation (region)	Soybean Oil Quantity (MT)	Soybean Oil Value (1,000 $)	Palm Oil Quantity (MT)	Palm Oil Value (1,000 $)
Pakistan	168,439	105,116	152,912	86,148
India	412,229	294,367	388,278	232,047
Bangladesh	53,677	31,896	-	-
Jordan	4,563	3,467	1,986	1,550
Japan	137	1,639	142,473	84,512
Turkey	40,115	31,193	-	-
China	129,533	104,570	29,432	18,302
All Asia	1,136,874	808,067	1,030,796	614,774
World	2,485,365	1,678,410	2,266,039	1,258,823

Source: FAO, FAO Trade Yearbook 1979, Vol. 33, Rome, 1980.

THE COMPARATIVE ADVANTAGE OF EDIBLE OIL PRODUCTION IN PAKISTAN

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THE EDIBLE OIL SITUATION IN PAKISTAN

In 1981/82, domestic oilseed production was estimated at 1.82 MMT from 2.65 million hectares, compared with an output of 1.71 MMT from an area of 2.63 million hectares in 1980/81. Cottonseed contributes nearly two-thirds of domestic edible oil production, with the remainder supplied by rape, mustard, soybean, sunflower and safflower seeds.

In fiscal 1982/83, edible oil imports are estimated at 450,000 MT. Domestic edible oil supply, after processing, is estimated at 238,000 MT. Of a total supply of 800,000 MT, 568,000 MT will be used in making vegetable ghee, 76,000 MT for liquid edible oil (including 15-20,000 MT for refined oil for direct consumption), and the remainder for industrial uses. Accordingly, slightly more than 62 percent of all edible oil supplies for Pakistan will be imported. In 1981/82, the import of 465,000 MT of edible oil cost Pakistan 254 million dollars, of which 133 million dollars were spent on commercial sales.

The GOP policy has been to promote increased self-sufficiency in the production and utilization of edible oils. Production increases are anticipated in the newer oilseed crops--sunflower, soybean and safflower; support prices are operated for these crops. The GOP controls the price of domestic cottonseed oil and imported oils. Cottonseed oil is sold to the Ghee Corporation at Rs 250/md. A price ceiling is also operated for ghee at the retail level.

COMPARATIVE ADVANTAGE

According to the theory of comparative advantage, trade can be mutually beneficial and nations with different factor endowments can gain the most by producing a product for which they are best endowed. In the case of Pakistani edible oil imports, a major concern in the design of a donor project is the degree to which Pakistan has a comparative advantage relative to the world economy.

In theory, comparative advantage calaculations are simple. It would be advantageous to import if (1) a comparison of the international border price with the domestic resource cost shows that it would be less expensive to import; and (2) there are other commodities that could more efficiently utilize domestic resources and offset the cost of the imports.

The following factors complicate the use of comparative advantage calculations:

1. Domestic resource costs tend to diverge from market prices when the economy is subject to state controls.

2. Certain domestic factors, particularly labor, are difficult to price when there are mixed forms of economic activity.

3. Trade patterns are linked to the historical legacy of political and social organizations. In Pakistan, the character of British colonialism is strikingly reflected in the present pattern of trade.

4. In several cases, comparative advantage considerations are secondary relative to national security and self-sufficiency desires. While these objectives may not be strictly economically rational, by short-run calculations they do underscore the dynamic and intersectoral nature of trade decisions.

5. The comparative advantage question is complicated by the looming problem of Pakistan's balance of payments deficit.

To estimate Pakistan's comparative advantage position requires an understanding of the costs attached to the various means that can be used to achieve self-sufficiency. To add a dynamic element to comparative advantage calculations requires an ability to predict future movements in international prices, domestic factor costs and production technology. Calculations of comparative advantage based on a short-term assessment of cost and production possibility are of limited use in an environment of rapidly changing costs and techniques.

The following presents a preliminary assessment of Pakistan's comparative advantage in edible oilseed production. Included is an estimation of the trade gap for edible oilseed production, a nominal-price comparison with imports, a discussion of the foreign exchange constraint of maintaining imports and implications for policy makers.

THE TRADE GAP FOR EDIBLE OIL PRODUCTS

Comparative advantage calculations depend on an estimate of the supply and demand for edible oils. The difference between final demand and domestic production must be met through imports, higher prices or rationing. Historically, the GOP has filled the trade deficit through a combination of imports and controlled scarcity, which itself is a form of rationing.

Per capita consumption of edible oilseeds has been growing at an estimated seven percent per year since 1970. The increase in final demand for edible oils is due to population growth, income growth, increased urbanization and a change in tastes and

preferences from desi ghee (with a milk base) to vegetable ghee and vegetable oil.

In 1971/72, average per capita consumption of desi ghee was .22 seer per month, and consumption of vegetable oil was .43 pounds per month. Consumption of both desi ghee and vegetable oil was more equitably distributed across income groups than was the consumption of chicken and eggs (Table 1). The consumption of edible oils in 1971/72 was less equitably distributed across income classes than that of wheat or rice.

Table 1

Monthly Per Capita Consumption of Major Food Items by Income Groups (1971/1972)

Monthly Income Groups (Rupees)	Wheat (seer)	Rice (seer)	Desi Ghee (seer)	Veg. Oil (lb)	Mustard Oil (seer)	Eggs (No.)	Chicken (No.)
All Groups	12.01	1.38	.22	.43	.03	1.56	.15
Less than 50	11.27	2.32	.12	.16	.03	.13	.03
50 - 99	11.45	.92	.17	.42	.01	.15	.01
100 - 149	11.65	1.31	.18	.41	.01	.83	.16
150 - 199	11.88	1.40	.20	.37	.02	.69	.20
200 - 249	11.82	1.28	.22	.37	.02	.55	.09
250 - 299	12.09	1.33	.22	.40	.03	.74	.04
300 - 399	12.14	1.45	.23	.39	.04	1.59	.04
400 - 499	12.10	1.61	.25	.45	.04	2.98	.07
500 - 749	12.72	1.49	.26	.56	.04	2.65	.28
750 - 999	11.28	1.32	.23	.76	.04	9.83	.29
1000 - 1499	12.11	1.56	.32	.83	.04	13.64	1.08
1500 - 1999	16.38	2.10	.44	1.20	.04	5.66	.31
2000 - above	17.08	1.69	.49	1.26	.03	5.46	1.08

Source: Statistical Division, Ministry of Finance, Planning and Development, Household Income and Expenditure Survey, 1971-1972, Karachi, 24 December 1973.

To forecast future demand for edible oils requires use of a set of demand parameters. These can be estimated cross-sectionally from consumption surveys or from historical data on consumption and relevant explanatory parameters. There are a variety of sources for the estimation of oilseed demand parameters. Estimates do vary widely and, for planning purposes alone, it is important to develop a consistent set of demand parameters. This

forecast will draw on the income-elasticity and own-price elasticity estimates of Mr. A. M. Khalid, based on an analysis of edible oil consumption data from 1972/73 to 1980/81.[1] In addition, IBRD estimates for population growth and income growth rates shall also be drawn upon.

The estimates and baseline demand estimate that are employed are as follows: Income Elasticity: .92; Price Elasticity (ghee retail price): -.61; Population Growth Rate: 3.0 percent; GDP rising at 6.2 percent; 1981/82 Edible Oil Consumption: 698,000 MT. Using these parameters, a series of demand projections can be made. These projections depend on a wide range of assumptions, including stable relative prices of competing products, fixed tastes and preferences, distribution-free consumption, constant growth rates and elasticities throughout the next decade.

Using the baseline data and the elasticity estimates, demand projections can be made. For policy purposes, it is useful to estimate the demand for edible oils when the price of ghee is neutral and when it is rising. In Table 2, two sets of projections have been made. Projection A assumes that the real price of ghee remains at present levels, and Projection B assumes that the price of ghee declines by five percent per year. Incomes and population are assumed to grow at the rates specified above.

These estimates show that if present trends persist, domestic demand for oilseeds may expand by 77 percent over the next ten years. Even with a positive price policy, domestic demand will continue to rise by 30 percent over the next ten years. Trade implications of an expanding domestic market for edible oils can be clearly appreciated by comparing demand with supply projections.

Production of edible oils in Pakistan registered a decline from 243,000 MT in 1973/74 to 233,000 MT in 1981/82. On average, however, total production of edible oils grew by 1.2 percent from 1973 to 1982. The years 1975 and 1976 were particularly poor for edible oil production (Table 3). Domestic production did not reach the 180,000 MT mark.

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[1]A. M. Khalid, "Pakistan: Edible Oil Supply and Demand," (draft copy), USAID, November 1982. There are a variety of sources for the assessment of demand parameters for oilseeds. See, in particular, "Rising Demand of Edible Oil," Pakistan Agriculture, July 1982, pp. 26-28. Other sources have estimated an income elasticity of .7 based on a cross-sectional assessment from the 1971/72 household expenditure survey. For an example of this see UNDP/FAO, Commodity Policy Study on Oilseeds, Edible Oils, Oilcakes and Meals: Pakistan, Rome, 1975. Further clarification of the demand picture will have to await the publication of the more recent 1979/80 household expenditure and consumption survey results.

Table 2

Demand Projections for Edible Oil in Pakistan*
(1,000 Metric Tons)

Year	Quantity Demanded Projection A	Quantity Demanded Projection B
1981/82	698	698
1982/83	739	716
1983/84	783	735
1984/85	829	754
1985/86	878	774
1986/87	930	795
1987/88	985	816
1988/89	1,043	838
1989/90	1,105	861
1990/91	1,170	884
1991/92	1,239	908

*Projection A is based on a 6.2 percent growth of GDP, a three percent growth in population and no change in real ghee prices. Projection B assumes that ghee prices are allowed (or fixed) to rise by five percent annually.

Table 3

Domestic Production and Import of Edible Oils
Pakistan: 1973-74 to 1982-83
(1,000 Metric Tons)

Year	Cottonseed Oil	Rapeseed Oil	Others	Total	Imports
1973-74	140	92	11	243	167
1974-75	127	83	10	220	194
1975-76	75	90	11	176	267
1976-77	76	90	12	178	285
1977-78	97	100	13	209	300
1978-79	121	110	20	251	312
1979-80	106	74	15	195	405
1980-81	106	82	15	203	460
1981-82	125	88	20	233	465
1982-83*	135	90	20	245	527

*Projections.

Percent average growth rate (1973-74 to 1982-83) = 1.21

Source: Aide Memoire on Pakistan's Requirements of Edible Oils/Fats (1974-75 to 1982-83).

Pakistan can increase the domestic production of edible oils in a variety of ways. In certain areas, edible oil production competes for land with cotton, corn or fodder. One means of increasing production would be to expand the area of edible oils cultivated and reduce that of competing crops. Another means of increasing production would be to expand oilseed production on fallow lands. In parts of the Barani zones of the Punjab and the Sind, cropping intensity is estimated to be as low as .7, suggesting considerable land-time is available for the cultivation of short-period crops. But production increases will more likely stem from a combination of increases in yields and in area planted with oilseed crops.

According to the Pakistan Agricultural Research Council, yields of the oilseed crops can be increased if a variety of biological and socio-economic constraints are overcome. These include inadequate seedbed preparation, unavailability of certified seed of improved varieties, low plant population per unit area, low fertilizer application, no plant protection cover, damage due to birds, pests and animals and unavailability of needed equipment. Socio-economic constraints include market price uncertainty, narrow markets, inadequate financing and an insufficient extension program. In addition to the above, one would also have to list low prices and an isolated and antiquated research system as further constraints to higher production. All of these factors can be overcome. The government seems to be recognizing these problems and is taking action to address them (Table 2).[2]

Another means of raising the domestic production of edible oil would be to improve the processing efficiency of oilseeds. Fifteen solvent plants that can now extract up to 98 percent of the oil from the seed are operating at only 11 percent of total capacity due to profitability problems. The bulk of the domestically produced cottonseed, rape and mustard seed oil is processed in kohlus (ox-driven expellers) or by mechanical crushers. Solvent extraction is nearly 20 percent more efficient than mechanical extraction and nearly 50 percent more efficient than kohlus. Developing a market for the domestic use of oilseed meal should provide an incentive for the increased use of solvent plants. This would lead to a higher processing efficiency and an increased domestic availability of edible oil.

If the area sown to oilseeds is increased, or if the technical or socio-economic constraints are loosened, an increase in the domestic production of edible oil should occur. In Table 4, estimates of annual edible oil production are presented. These figures assume a continuation of the present rate of growth, twice that amount and three times that level. Under the "optimistic" projection with a growth in output of 3.6 percent per year, production would rise to only 332,780 MT in 1991/92. If

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[2]Amir Muhammed and A. Rehman Khan, Perspective of Edible Oils Research and Production in Pakistan, Pakistan Agricultural Research Council, Islamabad, 1981.

Table 4

Supply Projections for Edible Oils in Pakistan
(1,000 Metric Tons)

Year	Rate of Growth (1.21%)*	Rate of Growth (2.42%)*	Rate of Growth (3.63%)*
1982-83	235.82	238.64	241.45
1983-84	238.67	244.41	250.21
1984-85	241.56	250.32	259.29
1985-86	244.48	256.38	268.70
1986-87	247.44	262.58	278.45
1987-88	250.43	268.93	288.56
1988-89	253.46	275.44	299.03
1989-90	256.53	282.10	309.88
1990-91	259.63	288.93	321.13
1991-92	262.77	295.92	332.78
1992-93	265.95	303.08	344.86
1993-94	269.17	310.17	357.38
1994-95	272.42	317.92	370.35

*Projections made from total domestic production of edible oils.

ghee prices increased by five percent per year, as in Projection B of the demand assessment, in 1991/92 the trade gap would have widened to 575,000 MT, a 24 percent increase in ten years. Under present conditions, with no increase in the production growth rate and a stable ghee price, the trade gap could be expected to be as large as 976,000 MT--a 110 percent increase in ten years. That is a level that the Pakistan economy could ill afford to bear.

A PRICE COMPARISON: PAKISTAN AND THE WORLD MARKET

The GOP operates a number of direct and indirect price controls for edible oils. The price of cottonseed is fixed by variety. For desi (village) variety, the 1981-82 procurement price is Rs 154.69/md (md = 37.28 kg). The GOP also fixes the marketing margin an processing charge of oil extractors. Furthermore, by regulating the profits of the Ghee Corporation, the GOP is able to effectively control the retail price of ghee as well. Because many other edible oils may be substituted easily with cottonseed oil, price controls are indirectly effective in the other oilseed markets. In an effort to stimulate nontraditional oilseed

production, the GOP has also enacted support prices for soybeans, sunflower and safflower.

A comparison of cost of production and market prices, as shown in Table 5, suggests that oilseeds vary considerably in profitability. The return from a pure stand of rape and mustard can be greater than that of an equal area of winter wheat or gram. The return from an acre of soybean, sunflower or safflower would be less than half that of maize. Cost of production and returns estimates are complicated by the measuring system and the price used to represent the farm-gate value.

Table 5

Costs and Returns from Major Crops in Pakistan

Season/ Crop	Price per 100 kg (Rs)	Yield (kg/ha)	Gross Return (Rs)	Cost of Production (Rs)	Net Return (Rs)
Rabi (Winter)					
Rape/Mustard	375	922	3458	2277	1181
Safflower	241	830	1660	1859	(-) 199
Wheat (Irrigated)	125	2398	3422	2648	744
Wheat (Barani)	125	922	1285	1221	64
Gram (Barani)	287	646	1854	881	973
Kharif (Summer)					
Seed Cotton	429	922	3955	2604	1351
Groundnut	500	1500	7500	4676	2824
Sunflower	295	1015	2994	2557	437
Soybean	268	922	2471	2261	210
IRRI-6 (Paddy)	131	4150	5436	2956	2480
Basmati (Paddy)	200	2305	4610	2967	1643
Maize	155	2582	4002	3245	757
Millet (Barani)	225	554	1246	852	394

Source: A. Muhammed and A. Rehman Khan, Perspective of Edible Oils Research and Production in Pakistan, Pakistan Agricultural Research Council, Islamabad, 1981.

A more serious omission is that of the risk element from profit calculations. Rapeseed and mustard, grown in a pure stand, are

high-risk crops. The probability of marketing a full acre's yield is rather low and, as such, farmers are wise to lower their profit forecasts to account for high production and marketing risks. The combination of low profit and high risk for several oilseed crops contribute to an atmosphere in which a minimum of cash inputs and production investment are used in cultivation. This is less true for cotton, although it is primarily produced for lint rather than for oil.

Table 6 indicates that the prices of edible oils on the world market have been sharply depressed since 1978/79. The export price of U.S. soybean oil has declined, in nominal terms, by 31 percent between 1977/78 and 1981/82. The export price of palm oil also declined 27 percent during that period. The declines in the world market price are primarily due to bumper soybean crops in the United States, strong palm oil crops in Malaysia and Indonesia and Argentina's entry into the world soybean export market. Rapid expansion of world supplies has brought the international price of edible oil below that of the domestic price of Pakistani edible oil.

Pakistan imports edible oil through the Trade Corporation of Pakistan (TCP), as well as through private channels. In 1981/82, nearly 430,000 MT were imported by the TCP and 70,000 MT were purchased by private traders. Imported oil passes through the ports duty free, but a five percent docking charge is applied. Despite port costs for soybean oil and palm oil, importing them has been significantly less expensive for the past two years than to domestically produce cottonseed and mustard oil.

Before 1978, the domestic price of cottonseed oil was largely determined by the international price of soybean oil. Since 1978/79, the TCP has been importing soybean and palm oil and selling it at a profit to the Ghee Corporation (GCP). The reverse was true until 1978/79.

In 1980/81, Pakistan imported 460,000 tons of palm oil and 220,000 tons of soybean oil at a cost of 203.5 million dollars. In September 1982, soybean imports had an average cost of $446.56 per metric ton, while the average cost of palm oil imports was $372.00 per metric ton. The landed cost of soybean oil, at the Karachi port, was Rs 6,302 per metric ton, while the landed cost of palm oil was Rs 5,259 per metric ton (Table 7).

Private traders are buying soybean oil for $25 less per ton than the government. The private traders are buying from Spain and Brazil, capitalizing on their lower export prices. A TCP official estimates that India is purchasing soybean oil at $410 per ton, nearly $36 dollars less than the amount paid by Pakistan, because India purchases the edible oil in lots of 100,000 MT or greater.

Table 6

Vegetable Oil Prices[a]
(U.S. Dollars/Metric Ton)

Average	Soybean U.S.[1]	Soybean Rott[2]	Cottonseed U.S.[3]	Cottonseed Rott[4]	Sunflower U.S.[5]	Sunflower Rott[6]	Peanut U.S.[7]	Peanut Rott[8]	Palm Rott[9]	Rapeseed Rott[10]	Coconut Rott[11]	Linseed Rott[12]
1977/78	539	576	561	630	591	618	817	1,007	564	580	600	401
1978/79	603	654	697	780	725	768	798	990	652	628	970	601
1979/80	536	613	559	683	573	634	609	782	597	582	746	677
1980/81	502	540	569	666	594	666	892	1,112	589	510	583	692
1981/82	418	463	443	582	550	557	609	667	479	438	500	559

[1]Average, wholesale, crude, tank decatur.
[2]Dutch, Free on Board (FOB) ex-mill.
[3]Crude, tank cars, FOB valley points.
[4]U.S., PBSY, Cost plus Insurance and Freight (CIF), Rotterdam.
[5]FOB Minneapolis.
[6]Any origin, ex-tank, Rotterdam.
[7]Crude, tank cards, FOB, S E. mills.
[8]Any origin, CIF, Rotterdam.
[9]Sumatra/Malaysia, CIF, Northwestern Europe.
[10]Dutch, FOB ex-mill.
[11]Philippines/Indonesia, CIF, Rotterdam.
[12]Any origin, ex tank, Rotterdam.

Based on a 1 October to 30 September calendar year.

Source: USDA, Foreign Agriculture Service, Foreign Agriculture Circular: Oilseeds and Products, October 1982.

The TCP has contracted with the GCP to supply it with edible oil at a price of Rs 6,698 per metric ton. The TCP assumes the responsibility for one month's storage of the edible oil, and all other expenses are borne by the GCP. At a procurement price of Rs 6,698 per metric ton, the TCP makes an average of Rs 1,439--or $113--per metric ton sold. In comparison, the 1981/82 price of domestically produced cottonseed oil was Rs 6,702 and of mustard oil, Rs 8,049 per metric ton.

Table 7

A Comparison of CIF Costs for Soybean Oil and Palm Oil with the Domestic Price of Selected Oils (U.S. Dollars per Metric Ton)

Year	Soybean Oil[1]	Palm Oil[2]	Cottonseed Oil[3]	Mustard Oil[4]	Vegetable Ghee[5]
1977/78	540	564	541	622	978
1978/79	604	652	773	877	989
1979/80	537	597	541	1,015	1,088
1980/81	503	589	654	950	1,096
1981/82	419	480	677	813	1,104

[1]Average, wholesale, crude, tank decatur plus $1.10 per ton for shipping.
[2]Sumatra/Malaysia price, CIF, Northwestern Europe.
[3]Wholesale price quoted on the Lahore Market.
[4]Wholesale price quoted on the Lahore Market.
[5]Average consumer price.

Source: USDA Foreign Agriculture Service, Foreign Agricultural Circular: Oilseeds and Products, October 1982; and Ministry of Finance, Pakistan Economic Survey 1981-1982, Islamabad, Pakistan.

Although present-period comparisons suggest it is in Pakistan's comparative advantage to import edible oil supplies, several other factors must be considered. First, the decline in international vegetable oil prices is showing signs of reversal. If the secular decline in vegetable oil prices is followed by a secular rise on the order of the 1977/78 to 1978/79 rise in soybean prices, in a few years Pakistan's domestic production will be competitive with world prices. For example, had the secular decline in international vegetable oils not occurred during the last three years, and had prices followed the trends of the early 1970's, the present price of soybean oil would be approximately $850--or Rs 10,752--per metric ton.

Consequently, it is important to distinguish between a short-term movement in international edible oil prices and a structural change in the international vegetable oil market, which would preclude a continuation of the rise in world prices. A related point is that Pakistan is financing its imports at the cost of an expansion of national debt and with a deteriorating balance of trade situation. For fiscal considerations alone, a strong argument could be made for protecting the edible oilseeds sector as an infant industry depressed by the downward movement of international vegetable oil prices.

THE COST OF FOREIGN EXCHANGE

Ultimately, the availability of foreign exchange will determine Pakistan's ability to import edible oils. Foreign exchange, earned through trade or granted in aid or credit, carries with it a cost. The presence of trade barriers, exchange controls, banking regulations and other factors introduces a bias into the pricing of foreign exchange. Accordingly, estimates of real costs, or shadow prices, are used to approximate the domestic cost of foreign exchange.

The shadow price of foreign exchange can be computed in several ways. Conceptually, the value of foreign exchange is equal to the real domestic value of a basket of Pakistani goods produced for export that would offset the cost of edible oil imports. In opportunity cost terms, the value of the foreign exchange expended for the import of edible oils is equal to the gain in producer and consumer surplus that would have occurred if the next-best set of imports had been purchased. For example, had Pakistan imported a brick factory instead of importing oilseeds, the real exchange cost of importing oilseeds would be equal to the gains that society would have reaped from the next-best import opportunity--in this case, assumed to be a brick factory.

The capacity to afford edible oil imports depends on Pakistan's ability to generate foreign exchange. Exchange is generated through overseas trade, remittances from abroad and extragovernmental trade, credit and assistance. Through a host of import/export, banking and currency allocation controls, the GOP can regulate the amount of exchange allocated to any sector of the economy and indirectly, the cost of that exchange to each sector.

During the past decade, Pakistan's chronic trade deficit has placed considerable pressure on foreign exchange reserves. According to the World Bank, Pakistan's current account deficit widened from 990 million dollars in fiscal year 1980/81 to 1.39 billion dollars in 1981/82. A current accounts deficit of roughly 1.5 billion dollars was forecast for fiscal 1982/83. In light of the decline in demand for Pakistan's primary exports--cotton and rice--the deficit will have to be revised upward considerably. It is also important to appreciate the contribution of workers' remittances to the balance of payments.

In 1980/81 and 1981/82, workers' remittances were estimated at an average of 2.1 billion dollars. These remittances depend on the availability of employment for Pakistanis in the Middle East, Europe and North America. Any disruption that would close the market to Pakistanis working overseas--for example, in Saudi Arabia--could lead to an immediate doubling of the current accounts deficit. While this is a precarious situation, it is

important to underscore that Pakistan's balance of payments situation has, thanks to import liberalization policies, good crops, favorable export prices and a partial rescheduling of debt from the Pakistan consortium, improved considerably from the first seven years of the 1970's.

In 1976/77, Pakistan's current accounts balance was an estimated 6.7 percent of GNP. This has declined to 3.3 percent of GNP in 1980/81, although with the recent decline in export earnings, the deterioration in balance of payments is expected to surpass that of the early 1970's.

Edible oil imports are the third largest contributor to public sector imports, behind petroleum products and defense-related imports. While the level of edible oil imports has increased dramatically in the past four years, a decline in international prices has led to slower growth in edible oil import expenditures than for petroleum products or defense expenditures. Nonetheless, edible oil imports for 1982/83 are projected to be somewhere between 480 and 500,000 MT, depending on the size of the domestic crop.

Using the framework referred to earlier, Pakistan's ability to maintain this level of imports depends on (1) its ability to generate foreign exchange; and (2) in the case of oilseeds, the ability to attract concessionary term imports. The dependence on concessionary imports and on workers' remittances for a large share of foreign exchange casts doubt on the ability of Pakistan to maintain an expansionary import regime (Table 8).

Table 8
Pakistan's Current Accounts Balance and Composition of Selected Merchandise
(Millions of Rupees)

	1978/79	1979/80	1980/81[1]	1981/82[2]	1982/83[3]
Exports (FOB)	1,644	2,341	2,798	2,796	3,400
Imports (FOB)	3,816	4,857	5,563	5,851	6,630
of which:					
EDIBLE OIL	243	247	246	248	
Petroleum (POH)	611	1,237	1,602	1,667	
Defense Items	511	602	761	954	
Trade Balance	-2,172	-2,516	-2,765	-3,055	-3,230
Workers' Remittances	1,345	1,748	2,097	2,155	2,370
Current Accounts Balance	-1,114	-1,140	- 991	-1,389	-1,482
Trade Balance as % of GNP	10.3	9.9	9.2	9.1	3.8
Current Accounts Balance as % of GNP	5.3	4.5	3.3	4.1	3.6
Oilseed Imports as % of Total Imports	6.3	5.1	5.0	4.2	

[1]Provisional.
[2]Government estimate.
[3]Government projection with IBRD modifications.

Source: IBRD, Pakistan Economic Developments and Prospects, 14, April 1982.

The opportunity cost of the loss of Pakistan's foreign exchange from the import of edible oils is accumulated debt and the implicit loss to society. The cost to society occurs because the next-best set of imports did not command the use of foreign exchange. For a country of Pakistan's level of socio-economic development, the import of productive goods for the agricultural sector, in particular, should command priority over the import of consumption goods.

APPENDIX TABLES

Appendix Table 1

Average Wholesale Prices of Oilseeds and Oils
1972/73 to 1981/82
(Rs/40 kg)

	Oilseeds[1]		Oil[2]	
Year	Cottonseed	Rapeseed/ Mustard	Cottonseed	Mustard
1972-73	31.49	55.32	145.10	134.56
1973-74	37.74	72.97	187.96	192.51
1974-75	57.47	97.90	226.91	253.73
1975-76	55.73	107.07	250.52	272.92
1976-77	63.69	76.66	225.60	226.14
1977-78	60.57	82.72	214.39	246.14
1978-79	71.67	121.80	306.33	347.43
1979-80	65.92	133.67	214.33	402.22
1980-81	75.31	135.04	258.97	376.67
1981-82*	88.32	109.39	267.90	322.22

*July-March.

[1]Prices quoted are on the Faisalabad market.
[2]Prices quoted are on the Lahore market.

Source: Pakistan Economic Survey 1981-82 (Table 8.5), Ministry of Finance, Government of Pakistan, Islamabad.

Appendix Table 2

Procurement Prices of Various Varieties of Seed Cotton (Phutti)
Pakistan 1976/77 to 1981/82
(Rs/37.328 kg= Rs/maund)

Year	Desi	AC-134, NT	B-577,149	Sarmast, Gallandri, MS-39/40 Dellapine
1976-77	120.00	125.00	135.00	145.00
1977-78	132.00	138.00	149.00	160.00
1978-79	134.00	138.00	149.00	160.00
1979-80	134.00	138.00	149.00	160.00
1980-81	145.56	149.30	159.56	169.82
1981-82	154.89	158.62	166.09	179.15

Source: Pakistan Economic Survey 1981-82, Ministry of Finance, Government of Pakistan, Islamabad.

Appendix Table 3

Procurement Center Prices of Wheat, Pakistan 1971/72 to 1981/82 (Rs/maund)

Year	Price
1971-72	17.00
1972-73	22.50
1973-74	22.50
1974-75	37.00
1975-76	37.00
1976-77	37.00
1977-78	37.00
1978-79	45.00
1979-80	46.65
1980-81	54.17
1981-82	54.17

Source: Pakistan Economic Survey 1981-82, Ministry of Finance, Government of Pakistan, Islamabad.

Appendix Table 4

Distribution Center Prices of Important Chemical Fertilizers Materials 1978-1982 (Rs/50 kg bag)

Materials	Percentage of Nutrient Contents N	P	K	Effective Oct. 17, 1982	Effective Feb. 25, 1982	Effective March 16, 1982	Effective* Oct. 12, 1982
Urea	46	--	--	63.00	93.00	103.00	118.00
Diammonium Phosphate	18	46	--	67.00	100.00	105.00	121.00
Ammonium Sulfate	21	--	--	29.00	42.00	47.00	54.00
Nitrophosphate	23	23	--	46.50	78.00	84.00	97.00
Single Sulfer Phosphate	--	18	--	17.00	25.00	25.00	29.00
Calcium Ammonium Nitrate	26	--	--	36.50	50.00	55.00	58.00
Sulphate of Potash	--	--	50	27.00	30.00	30.00	35.00

*Business record dated 13 October 1982.

Source: Government of Pakistan Notification No.: C GOPS-144(5)F7, dated October 17, 1978.
Pakistan Economic Survey 1980-81, Ministry of Finance, Government of Pakistan, Islamabad.

Appendix Table 5

Average Consumer Prices of Selected Items in Pakistan 1972/73 to 1981/82
(Rupees)

Item	Unit	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	% Change 1972-73 to 1980-81*
Vegetable Ghee	Kg	5.27	6.60	8.44	9.64	9.67	9.66	9.80	10.77	10.85	10.93	107
Mustard Oil	Kg	3.64	5.30	6.88	7.69	6.76	6.82	9.39	10.86	10.87	9.69	166
Eggs, Desi	Dozen	3.24	4.41	5.24	5.84	6.40	6.86	7.41	7.98	9.36	10.85	235
Eggs, Commercial Farm	Dozen	3.20	4.33	5.17	5.42	5.98	6.29	6.06	6.59	7.58	8.35	161
Milk, Fresh	Liter	1.39	1.80	2.47	2.71	2.92	3.11	3.15	3.48	3.79	4.13	197
Beef	Kg	2.79	4.03	5.74	6.45	6.47	6.82	7.39	8.09	9.73	10.66	282
Mutton	Kg	6.37	8.45	10.82	12.43	12.46	15.13	16.64	18.13	21.32	24.02	277
Washing Soap	Bar	0.75	0.86	1.09	1.05	1.36	1.36	1.33	1.51	1.67	1.63	117
Life Buoy	Bar	0.79	1.04	1.37	1.41	1.43	1.57	1.70	1.99	2.24	2.33	195

*July - March.

Source: Pakistan Economic Survey 1981-82 (Table 8.6), Ministry of Finance, Government of Pakistan, Islamabad.

Appendix Table 6

Production and Per Capita Consumption of Vegetable Ghee Pakistan 1970-71 to 1982-83

Year	Population[1]	Production[2] (Tons)	Annual Per Capita Consumption (Kgs)
1970-71	61,490,000	136,000	2.25
1971-72	63,340,000	162,000	2.60
1972-73	65,240,000	187,000	2.91
1973-74	67,200,000	225,000	3.40
1974-75	69,210,000	272,000	3.99
1975-76	71,290,000	277,000	3.95
1976-77	73,430,000	326,000	4.51
1977-78	75,630,000	360,000	4.84
1978-79	77,900,000	422,000	5.51
1979-80	80,230,000	452,000	5.72
1980-81	82,600,000	505,000	6.22
1981-82	85,000,000*	558,000	6.67
1982-83	87,550,000**	600,000*	6.97

*Provisional.
**Projected on the basis of three percent annual growth.

[1]Pakistan Economic Survey, 1981-82, Ministry of Finance Government of Pakistan, Islamabad.

[2]Data on production for the period 1971-72 through 1980-81 has been taken from Pakistan Economic Survey, 1981-82, and for the period 1981-82 to 1982-83 from Aide Memoire on Pakistan's Requirements of Edible Oils/Fats for the year 1982-83.

PART III

INSTITUTIONS AFFECTING OILSEED PRODUCTION AND MARKETING

STORAGE, PROCESSING AND DISTRIBUTION PROBLEMS

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February 15, 1983

Introduction

The information and observations used in formulating the following paper were collected during the period January 11 through February 9, 1983, in Pakistan. Background for the attached was obtained from a number of sources including:

(a) Considerable reading and study of literature and statistics on the subject.

(b) Discussions with GOP officials, government agers, private sector businessmen--both owners and operators, and heads of financial institutions in Karachi.

(c) The areas visited, i.e., Islamabad, Lahore, Multan and Karachi.

The basic problems in the edible oil sector are not very simple. Recognition of time constraints or, more important, realizaion of the sequence of events that must occur has not been given adequate attention in the past. However, if the sector is to attain a sense of order and direction in the next five years, Pakistan must focus on these probler . Several simple truths upon which this paper based and the "strategy" ought to be based, are as follows:

(a) There simply is not enough oilseed grown in Pakistan to support a more efficient processing sector than now exists.

(b) The current pricing system cannot support (1) more seeds, (2) greater conservation of existing seeds, (3) oil saving investment or (4) more efficient processing.

(c) The current tax structure, *vis-a-vis* the edible oil sector, functions more poorly than the pricing system.

(d) Given (a), (b) and (c), the GOP has a major processing industry--ghee.

(e) Existing processing capacity is inefficient and not viable in the long run but has to be improved (in its oil retention capability), since there is no alternative.

(f) The so-called solvent extraction capacity is smaller than officially proclaimed.

(g) As a result of (f), there is no "meal" problem in Pakistan and cannot be for five years.

(h) To make any progress in the sector, a tight central control over its various aspects and financial resources devoted to sector development must be exercised. In short, the GOP needs to demonstrate in a major way a commitment to solving the edible oil import problem.

A. Current Status Summary

With respect to storage, processing and distribution (SPD) matters, it is necessary to highlight some key facts relevant to other areas to accurately evaluate those activities and make recommendations. The following is an attempt to summarize key status factors as base points for an analysis of the edible oil industry as an agro-industrial complex or sector and as base points on which policy recommendations can be made.

Oilseed Availabilities

1. Locally produced quantity, particularly for ghee manufacture, is restricted to cottonseed. Since cottonseed is a by-product, the amount available depends on demand for cotton. Given world market conditions, cotton will not produce an appreciable increase of seed oil for production.

2. The only other major oilseed crops at present are rapeseed and mustard. Current varieties are not suitable for ghee manufacture but do produce edible oil at the farm or village level. New varieties of rape and mustard seed would have to be promoted in a major way to have a significant effect on the supply of oilseeds in the short term, i.e., three to five years.

3. The lack of seed availability not only affects current oil production potential but is also the key missing element on which new oil production capability can be based or justified.

Solvent Extraction Plants

1. Official data and other tabulations do not agree on the number of solvent extraction plants in the country. There are 14 <u>private</u> sector plants often quoted as operating or capable of being operated. Of the 14 listed by the Ministry of Industries, only five are known to have operated over the past four years:

   a. Two <u>private</u> sector plants in the Multan area linked with in-house ginning/textile plants and other aspects

of an integrated operation, i.e., liquid oil. Even with these, the reported percent oil recovery on cottonseed would indicate expeller operations rather than solvent extraction.

b. Another plant in Multan that operated 30-40 days last year, processing only sunflower under contract with the Ghee Corporation as it has done for the past three years. The company also warehouses, on behalf of the Ghee Corporation, the last three years' production of sunflower meal that remains unsold or unused.

c. Two Karachi plants now operating only for the production of oil for the soap industry. One operates one week a month, the other full time, processing rapeseed cake and rice bran. Both plants, representing pioneer establishments in Pakistan's edible oil fields, were firm and very emphatic about not getting back into the edible oil business.

2. Several plants thought of as private and included in the 14 are actually government owned. They were taken over when the adjoining ghee plants were nationalized. At least two are known to be scrap only, by admission of both the current GOP appointed managing directors and the former owners.

3. The age, condition and outdated capacity of these plants, given current production economicsand lack of available seed very much indicate there is little prospect that existing solvent plant capacity in Pakistan can make a measurable contribution to oil supplies. It is highly doubtful that the former owners or other private sector parties would come back into the picture utilizing these existing plants.

4. The only alternative would be for the GOP to operate these plants for the short term until new private capacity were built. It would probably take one to two years to put these plants into operation and since it would take one to two years to start that process, it would be 1986-87 before what is suspected to be a maximum of five to six plants could be resurrected. Their total net contribution would be limited. The GOP and others have wiser ways of devoting scarce resources in an edible oil strategy.

5. Related to solvent extraction is the question of meal production and use. Since the so-called existing solvent capacity could probably not come on stream and since seed availabilities and new solvent capacity are still the future, there is no present meal problem. There <u>is</u> a cake problem but little prospect that such a large quantity of meal can or will be produced over the next five years to cause immediate concern.

Expellers and Oil Mills

1. Preliminary data collected indicate there are probably 750-800 mills in Pakistan operating 4,000-5,000 expellers. The bulk of these mills are 1-5 expeller operations operating 40-80 days a year as part of an extended family economic activity. Of the 497 mills in Punjab, only 69 have 8 or more expellers.

2. Only the large operations have dehulling and delinting, the latter in most cases highly inefficient. It is safe to assume that of the 69, 10 or 20 at most have what could be considered efficient pre-processing.

3. Given a low fixed price and a one-buyer market for oil, the expeller is under no pressure and has no incentive to increase oil production. His true profit comes from scale of cake which, from the farmer's erroneous thinking, is better with maximum oil. The expeller is better off leaving hulls and lint in the cake since weight determines total sales value.

Summary Position

1. As inadequate as the present extraction industry is, it is the only one going and the only one likely for the next five years.

2. Given all the other elements in the sector that have to be developed, such as increased seed production which will take time, it will be three years before a believable feasibility analysis can be prepared that would show a viable solvent industry, particularly for a private sector operation.

3. Plants with a minimum capacity of 200 tons per day, preferably 500 tons per day, seem to be required, given today's production economics. Industry sources estimate there are four Pakistani facilities capable of local manufacture with an estimated construction time of 2.5 years. A single 200-ton plant is estimated to cost $15-20 million.

4. In the short to medium term, i.e., three to five years, the only major way to increase domestically produced oil seems to be increasing the recovery of oil in present seed, i.e., dehulling, delinting and preventing the waste of oil in the present processing industry.

B. Oilseed Production Incentive Payments

The prerequisite to increasing domestic oil supplies and laying the proper foundation for establishing a viable processing

and storage industry is a dramatic increase in the amount of oilseeds available for processing. The lack of oilseeds is the principal reason for low capacity utilization of the present industry and a substantial deterrent to entry of new processors into the industry or even operation and expansion of existing capacity. Increasing oilseed production is obviously the only way to satisfy rising demand (other than to raise imports) or to reduce the present import bill. This bill will increase substantially even before the effect of presently contemplated programs is reflected in increased seed and domestic oil availabilities.

For a short-term effect, there are limited crop choices. The supply of cottonseed is a function of the demand/price of lint and textiles, over which the oil sector has no control. Other oilseed crops such as groundnuts, safflower and soybean have some contribution to make. Their expanded cultivation should be vigorously pursued for a number of reasons, but they have serious limitations as far as having a short-term effect on the edible oil sector.

Two crops have some short-term potential:

(a) Sunflower. As an in-between crop on extensive fallow wheat, rice and cotton land and as one that can be planted and harvested on planted sugarcane land during its longer growing season.

(b) Rapeseed and Mustard. Particularly the new seed varieties that are higher yielding and without high acid and other adverse characteristics of present seed varieties. These crops are so widely grown, and therefore known in Pakistan, that a program should capitalize that fact.

A crash program on the above crops should be the priority task of an edible oil authority (EOA). Even under the best of circumstances, it is estimated that given growing season variations and organization time, for example, it will be three years before substantial results will be evident at any level of government promoting a program for rape and mustard seed.

The program for sunflower promotion is handled by the Ghee Corporation, which seems to be its only function other than running the nationalized ghee plants. The seed division of the Ghee Corporation with its already established offices at Multan, Islamabad and Hyderabad, and its already established extension service should be transferred to EOA and become the oilseed promotion division of EOA. This network of offices and extension service should be greatly expanded under tight central control. This division should have two separate activities:

(a) An extension office responsible initially for all activities related to seed distribution, farmer consultation and other aspects of a crash growing program on sunflower, rape and mustard seed.

(b) A development office responsible for all development and research efforts in Pakistan on all other oilseeds crops, i.e., groundnut, safflower and soybean. Properly funded, this office also should combine in one central organization the numerous ongoing R&D efforts of other agencies and research centers at various central and provincial levels. This should coordinate and consolidate efforts within Pakistan that now appear widely diffused and uncoordinated. As new crops are sufficiently tested and production problems solved so they can make a net contribution, the responsibility for their introduction and promotion would be assumed by the extension office.

The oilseed promotion division, through its extension office, not only would need to be expanded and adequately funded, but also would need sufficient leverage at the farmer level if an adequate crash and long-term program were to be successful. This should be provided both by price and other financial incentives and by aggressive extension services on an intensive basis. Regarding price and financial incentives, the following are suggested:

(a) A review of the existing price support/procurement level for sunflower to ensure it is adequate to promote widespread growing of the crop. This would be adjusted annually.

(b) A support price established for rape and mustard seed, restricted to those grown only from the new varieties sold by the extension office.

(c) An additional financial incentive would be provided for a five-year period by giving the grower a "fertilizer grant coupon" redeemable only for fertilizer at distribution points nearby.

The theory here is that you can only do one thing with fertilizer even though one farmer might sell off his allotment to another. The fertilizer would be used somewhere to increase yields. Assuming the farmer applied it to his own oilseed crop, it should have residual effects on the next crop. The fertilizer distributor would redeem these coupons for cash at the going market rates from a nearby EOA extension office.

The assumption is made that the cash flow of EOA will be sufficient to bear the cost of this grant program. The same coupon concept could be applied to fungicides and pesticides since rape

and mustard seed in Pakistan apparently experience substantial losses due to insects and other problems.

There is some concern that promoting a sunflower crop on fallow land will divert acreage from the production of food crops--principally wheat and rice or cotton. Acreage planted in cotton is determined by other market factors. Whatever the case, it should be possible to monitor and control this possible diversion by simply withholding the issuance of the grant coupons on the second and subsequent oilseed plants unless an appropriate "primary" crop had been planted the previous growing season. Another possibility would be an added "double-cropping" coupon to encourage continued primary and oilseed crop planting.

C. Other Policy Proposals

The following is not based on in-depth analysis but reflects more of what is possible and practical in the short and medium term. These proposals embody some action necessary to rationalize the edible oil sector in the near term and over the next ten years. By that time Pakistan should have reversed its present position and the sector would be better able to respond to the increasing demands made on it.

Basic Assumption Regarding Oilseed Availabilities

The assumption is that there will be no dramatic increase in cottonseed. Short and medium term increases would come from sunflower and new varieties of mustard and rapeseed. Medium to longer-term gains, however less significant, would come from groundnut, soybean and other crops.

Resulting Policy Proposals

1. While under the present system cottonseed oil output is controlled by being sold only to the Ghee Corporation, the real emphasis should be shifted to control of cottonseed output. This output is the basic source of edible oil supply.

    a. Ginners should be required to sell their seed to processing centers to be established in key centers in Punjab and Sind Provinces.

    b. Seed is a by-product of the ginning industry whose real profit base is lint. The price of lint will fluctuate over time, given market demand. Despite this prime product price fluctuation, the support price to be established and fixed for seed should consider two factors:

(1) Fixing the base price at current market levels and adjusting upwards by some factor to encourage maximum storage and protection, i.e., conservation of the seed produced from the ginning process. The upward adjustment is intended as an incentive payment added to the base price.

(2) Adjusting the support price annually before the cotton sowing season. This adjustment would be calculated through a detailed analysis of the cost of production factors in ginning. Changes over the past year would be noted and changes to occur over the next season determined, for example, announced minimum labor rate changes or negotiations and announced increases in electricity and gas rates. These two components then would be added to the base support price to determine the support price for the current season, which would then become the new base price for the following season.

2. A similar adjustment to base support/procurement prices would also be made at the farmer level for new varieties of mustard, rape and sunflower seed. The farmers' cost of inputs would be analyzed annually and adjustments made accordingly. Recognizing that the preponderance of small farmers does not have a basket of input prices, some calculation should be made, based on a consumer price index, as an adjustment to maintain a rising incentive for production. Again, such adjustments should be announced before the sowing season.

3. Rape, mustard and sunflower seed growers participating in the extension office program would be required to sell their output to processing centers to be established (see below) at the then-prevailing support price and be given a fertilizer coupon. Other growers would be free to sell their input in the free market. The bulk of farmers would enroll in the extension program and sell to the processing centers, given the reward incentive of the coupon.

4. The only instance where participating cotton, rape, mustard or sunflower seed growers could sell outside the EOA processing center system would be to licensed private processing centers. These centers would be licensed by EOA once they had demonstrated they had adequate storage, dehulling and delinting facilities maintained in satisfactory condition on an annual basis.

5. A substantially increased purchase price for cottonseed oil can be justified for a number of reasons, although the final level may be totally out of relation to other crops and by-products. The objective of a high purchase price would be to increase the amount recovered and offered for sale by

expellers, and probably would have little effect on the acreage planted since the prime motivation is lint production.

World market forces determine the annual acreage; therefore the total cost to the sector of a premium reward can be easily calculated and is virtually known. If the purchase price were high enough, the expeller would be justified in installing pre-processing, oil-saving equipment and squeezing the maximum out of the cake. If present cake contains up to eight percent oil, increase the purchase price of oil to an extent that only three to four percent is left in the cake. The purchase price of oil has to rise to the extent that it replaces cake as the profit center for the expeller. The farmer is still going to buy cake, even if it is only three to four percent oil. It is common knowledge that on the reduced ration, livestock will be just as healthy and produce just as much milk as before. The "shock" effect on farmers would last six to nine months.

Considering the cost of imports and other factors, there is a determinable price which Pakistan can afford to pay for cottonseed oil. That price may not bear any relationship to costs of cotton growing, expelling or other factors. It can be arrived at simply by calculating the savings to the sector and the GDP by recovering more than 100,000 tons of oil a year wasted in hulls, lint, waste water and cake. Even a high, contrived price would not introduce short or long-term imbalances in the cotton industry since the prime product is lint, whose quantity probably will not be affected by the price of oil.

Storage and Preliminary Processing

1. Medium-sized storage and preliminary processing centers should be established at selected locations. Cottonseed regularly collected from ginners to avoid losses in storage and spoilage, and mustard, rape and sunflower seed collected from farmers would be channeled into these centers.

2. In addition to the construction of adequate storage, dehulling and delinting facilities would be installed for cottonseed and sunflower. The seed thus prepared would maximize potential oil recovery and provide cash flow to the centers from the sale of (a) linters and (b) hulls and/or fuel processed for certain industries.

3. The centers would thus have a substantial inventory of maximum oil producing seeds in storage for sale to the expeller and eventually a solvent extraction industry. The sale from storage would be on an auction basis to expellers.

4. Medium-sized centers should be established because they could be sold to the private sector and provide the foundation for more thoroughly integrated operations through future expansion.

Processing

1. Oil extractors would purchase seed from centers at auction on a spot or contract delivery basis over a period of time during the year. This would permit sustained operations by those plants which purchase sufficient seeds at competitive prices. Eventually, the more inefficient extractors would not be able to compete.

2. The result of some of these auctions probably would be the exit from the industry of small or inefficient extractors, although they would be as free as any to bid on the going auction prices of seeds.

3. Future entry into the oil extraction industry, whether by expeller or solvent plant operators, should be controlled by EOA. Entry would reflect installation of adequate pre-processing and oil saving measures. Pakistan can ill afford to permit inefficient operators to remain in business when the cost is the loss of oil through processing that is then reflected in increased imports.

4. From its cash flow sources, EOA should consider a program to buy out and thus retire from the industry the inefficient expellers. These expellers would generally be small, one to four unit mills, with old equipment that should be scrapped and thus difficult to price. The best should probably be a buy-out price based on an estimated five-year net income loss to the owner. This price would be paid as a lump sum, the equipment removed and scrapped and inefficient units ultimately closed down.

5. The surviving extractors would be free to sell their oil to any bidder, including the Ghee Corporation, which would then be forced to purchase raw material on a price-competitive basis, i.e., operate, produce and market on a competitive free market basis. Private liquid oil blenders and ghee plants could purcahse this oil as well.

6. Several net effects of the above system are as follows:

   a. The price of ghee probably would rise, reducing demand.

   b. Consumers would shift to liquid oil, which would be advantageous from a health standpoint.

   c. Hydrogenation only adds cost to the end product, and the net effect would be to limit by price the demand for ghee to those who absolutely prefer it and are willing to pay the price.

D. Price and Tax Implications

The combined, hoped-for effect of policy and program initiatives that will emerge from current donor efforts and later programs by other concerned organizations will largely be nullified unless there is a serious readjustment of the prevailing pricing system, rationalization of current and new taxes and a more realistic pricing of foreign exchange available for private sector imports.

Several observations are offered regarding the existing price system, most of which are related to cottonseed, the only crop where there is sufficient experience or pattern has been established. Rapeseed, unfortunately, has been ignored, but perhaps just as well since a sensible industry price structure could emerge about the same time new seed varieties could have a real effect on supply. Sunflower also is available only in limited quantities, but a price structure could emerge before the crop's potential is seriously curtailed. The following is recommended for cottonseed:

(a) Present production of all cottonseed oil must be sold to the Ghee Corporation at a fixed price.

(b) That price is probably too low since there seems to be little evidence of expellers investing in new equipment dehullers and delinters to maximize the amount of oil produced from a given seed input.

(c) The true expeller profit appears to be in cake since farmers believe that high oil bearing cake is required as good livestock feed. Because they apparently are willing to pay the price, the expeller has only one customer for a fixed low price.

(d) The price of cottonseed at the ginners is uncontrolled. It is curtailed indirectly, however, by the limit on the price of oil produced from the seed.

There is an excise tax on the sale of ghee, which in 1981/82 amounted to 12.54 percent of the cost components of the ghee industry. There is no tax on the sale of liquid oil, either domestically produced or imported. The tax on ghee should be examined and rationalized with other taxes and prices.

There apparently is no restriction on the availability of foreign exchange to private importers of palm and soybean oil. The only requirement is licensing by the Trade Corporation of Pakistan (TCP). This is the one segment of the oil sector where the true dynamics of the private sector are permitted to flourish, and very handsomely at that. The anomalies and opportunities presented by current prices and industry practices and policies

create a situation where the private sector is only too willing to enter and earn, apparently, excise profits. Private imports are made at market rates, not at TCP rates to the Ghee Corporation. There is no excise tax on liquid oil as there is on ghee. Some cheap palm imports are sold as ghee since there is no policy, labeling enforcement or excise tax collection.

Implications

Other than the issue of all-out programs to increase seed availabilities, the second and equally critical need at present is a thorough study and rationalization of the entire price and tax structure as it relates to the edible oil sector. The GOP and others cannot make rational, long-range policy proposals and expenditures unless the conditions for success of either are understood and in place. The anomalies that currently exist in Pakistan do not permit this. Only when they are corrected can the GOP and others fully anticipate results from a multitude of programs proposed for the edible oil sector.

E. Establishment of an Edible Oil Authority (EOA)

It is almost impossible to consider Pakistan's edible oil sector without coming to the conclusion that a central control and development authority should be established. Another section deals with the need to consider the problems, programs and solutions on a sector basis which also permits rationalization of the industry and the crucial sector financial flows.

Given the immensity of the problem, the complicated interrelationships of its many components and the necessity for a coordinated approach, an authority at ministry level needs to be established. This authority should be established by presidential decree, subservient to no other ministry. The authority should be an autonomous body, empowered to take various actions without referral to other ministries, and above all, have its own sources of financing.

Fortunately, Pakistan has a precedent for such an organization and the concepts that must be accepted if progress is to be made. In 1977, the delays and disorganization of the Karachi Port and the up-country movement of goods and the down-country movement of exports became so severe, that the new government formed the National Logistics Cell (NLC), reporting directly to the Minister of Production. The NLC is run by the military. By near universal acclaim by the private sector and others, it has done a substantial job in clearing the port and expediting the movement of goods.

The Cell has its own budgetary allocation of both foreign exchange and rupees and does not report to any other ministry. It

has a substantial fleet of over-the-road equipment. The latter is significant since the concept of capital goods' acquisition and financial management by an autonomous agency has been accepted within the government framework. All this suggests the financial, legal and organizational structure of NLC deserves thorough study as a possible model and precedent for the establishment of EOA.

Another recent precedent seems relevant here. In 1977-78, the GOP surveyed another critical industry--cement--which had been nationalized. It analyzed the then eight GOP plants in terms of their future production capabilities--age of equipment, expenditure necessary to expand or modernize, size and probable duration of limestone deposits. Based on that analysis, the GOP decided to modernize four plants and eventually closed down the other four. The decision was then made that the new cement industry capacity should be in the private sector and sanctions issued accordingly. The precedent thus is there for a gradual return to the private sector of a critical industry. In the case of edible oils, this will require a free market, price/tax rationalization and (not unlike limestone) an assured supply of raw material, i.e., oilseeds.

The EOA would consolidate and coordinate all activities related to the edible oil sector. Given sufficient staff and technical assistance, the policy and program implementing authority in Pakistan would regulate critical parts of the market. It would be empowered to establish prices at various market points and establish the level of taxes on various activities and commodities. All this would be part of a coordinated program to reach a higher level of domestic production. Key areas of EOA's involvement would be as follows:

(a) Responsibility for all public sector imports of edible oil.

(b) Responsibility for new crop development and promotion.

(c) Administration of continuing research and development in growing, processing, etc.

(d) Management of required price support/procurement programs.

(e) Installation of dehulling and delinting facilities at central locations.

(f) Continual monitoring and establishment of price levels only in areas where the system cannot yet afford a free price mechanism.

(g) Establishment of tax levels at various points where taxes are necessary to either assist in contributing to the overall success of the edible oil strategy or to

regulate, balance and rationalize market conditions.

(h) Responsibility for establishing and implementing a disinvestment program on behalf of the GNP, of the operating unit of the Ghee Corporation.

F. Sector Analysis and Financial Flows

A sector economic and financial flows analysis, from imports and crop growing to sale of final product, needs to emerge to form the foundation on which various policy recommendations can be made and their effects ascertained. Thus, the critical areas regarding the sequential timing of various achievements can be identified so that the sector can move in a rational direction of reduced imports and increased domestic oil production. A financial flows analysis can accomplish the following:

(a) Assist in the analysis of the present state of the sector and the effects of various policy initiatives.

(b) Demonstrate the partial financial viability of the sector by segmenting income and output flows to finance and sustain a determined edible oil strategy implementation.

(c) Lead almost inevitably to further justification of establishing an EOA as the financial control agent for the sector, consolidating needed financial flows.

What is proposed is an analysis of the entire sector, revealing the potential sources of income and likely sources of expenditure, whether of a capital, R&D or price support nature. The purpose of this exercise is to divert present and future revenue sources from general public budgetary receipts to use within the sector to sustain a coordinated assault on the problem.

There are at present several major sources of fund flows that should be diverted to EOA:

(a) The Trading Corporation of Pakistan, the sole purchasing agent for the Ghee Corporation, handling imported palm and soybean oil requirements to meet its deficit. The Trading Corporation of Pakistan purchases at world prices and after adding considerably to the cost, sells to the Ghee Corporation. Based on an average per-ton differential between cost and sales to the Ghee Corporation of $113 per ton and Ghee Corporation imports of 391,000 tons, the profit to TCP should be $45-50 million annually, increasing in the future as

imports rise in the short term. Some TCP personnel familiar with the edible oil market and import program should be transferred to EOA to handle required imports for the Ghee Corporation. This should not require many personnel and only a small number of purchase orders.

(b) Excise duties and corporate taxes paid to the government by the Ghee Corporation amounting to Rs 630 million and Rs 39 million in 1981/82.

(c) Various sources of funds and technical assistance from the international aid and technical assistant community.

Oil Sector Development Financing

Whatever final policy initiatives emerge in establishing a ten-year edible oil sector development program, the financial requirements would be very sizeable. The mere financing of ongoing programs requires a substantial budget, let alone the capital expenditure in fixed assets and the financing of new initiatives eventually agreed upon. The three sources of funds mentioned above represent sizeable contributions and generate funds on an annual, recurring basis and are thus a good start to a sound financial base.

The edible oil sector is very complex and interrelated. That, plus the fact that policy initiatives must be coordinated, argues very strongly for a highly planned and controlled application of funds and policies to assure the maximum desired effect.

What is proposed is the single management of government sources and uses of funds related to the edible oil sector. All sources--import duties, excise taxes and excess profits on imports sold to the Ghee Corporation--would become budgetary receipts of EOA, rather than contributions to the treasuries of either the federal or provincial governments. Some of these revenue sources--whether duties or taxes--also could be adjusted as needed in a coordinated, overall sector program to bring about certain desired effects in the supply and demand of edible oils. At the same time, there also would be single management of uses to bring about the desired effect, principally on the supply side. This would encompass support/procurement programs, extension services, fertilizer grant coupon programs, new seed programs, research and development, and capital investment in huiling and delinting equipment.

A highly simplified schedule of sources and uses would illustrate the point with substantial elaboration. It would help shape the concept, the magnitude involved, and more importantly, provide a format on which the required sector policy initiatives can be carried out and managed. For example, some new policies and programs suggested in this paper are incorporated below. The sector costs and revenues of other suggested policies generated

by others also could be reflected in the following:

Sources

(1) "Profits" on sale of imported oil to the Ghee Corporation (formerly TCP)

(2) Excise tax revenues on ghee

(3) Excise tax revenues on liquid oil (proposed)

(4) Duties on private sector imports (proposed)

(5) Sale of dehulled, delinted cottonseed

(6) Sale of dehulled sunflower seed

(7) Corporate tax payments by the Ghee Corporation units

(8) Gross sales of imported edible oil to the Ghee Corporation

(9) Sale of linters

(10) Sale of hulls (cottonseed and sunflower)

Uses

(1) Extension services on sunflower, rape and mustard seed

(2) Support/procurement programs on oilseeds

(3) Initial installation of dehulling and delinting facilities (capital investment)

(4) Research and development activities

(5) Initial installation of new solvent extraction capacity (capital investment)

(6) Purchases of fertilizer/pesticides under the grant coupon scheme

(7) Imports of edible oil (palm and soybean) financed by GOP allotments of foreign exchange and other present sources

Stated very simply, the above process involves having consumption finance development. Creating EOA, charging it with development and rationalization of the sector and pledging existing and future financial flows to its support create a more logical and viable organization through which other funds can be channeled,

including additional GOP funds. Such an organization would be a preferable channel for outside assistance, either financial or technical. Donor agencies should welcome this development.

Private Sector Involvement

Given the present state of the sector, required new investment in processing must initially come from within EOA. This investment should deliberately be made, however, with ultimate sale to the private sector in mind. For example, the areas designated for the installation of dehullers and delinters should be large enough to accommodate the eventual installation of 200-500 tons per day solvent extraction plants. The theory here is that the time required to increase seed availabilities, install new equipment and for other policies (i.e., price rationalization) to take effect would all coincide in about two to four years. The net effect would be to create the atmosphere and conditions precedent for major private sector involvement.

In anticipation of that day, it should be a stated goal of EOA from the beginning to transfer as much of its capital improvements and programs as possible to the private sector. In that connection, an investment banker from EOA should be appointed to assist in the transfer of assets and, as an initiator or consolidating entity, to marshall future private sector involvement and financing. Probably the most aggressive institution in Pakistan today that could operate in that capacity is Bankers Equity, Ltd., Karachi. It has other attributes in its favor, including:

(a) Extensive involvement through shareholder relationship with the commercial banking community.

(b) Leadership in Islamic projects for financing packages which, if done correctly, would open the door for participation by Islamic institutions in other countries.

(c) Relationships that could be expanded with commercial, profit-oriented Arab institutions.

(d) Substantial experience in consortium financing, both debt and equity in rupees and foreign exchange.

Such an institution could establish a small specialist staff in edible oil sector undertakings to which the local private sector, foreign investors and lenders could turn for assistance.

Foreign Equity

One major point seems clear, arising from conversations with the local and foreign private sectors and from observations. Major investment by local private sector parties would probably have to involve joint foreign equity investment. The stigma of nationalization in the edible oil industry (as well as others) is too recent and too evident today in Pakistan. This situation would require joint participation by foreign interests if the local private sector were to come forth once again with major investment. Even at the height of nationalization in the 1970s, few, if any, units with foreign investment were nationalized.

G. Ghee Corporation of Pakistan

GCP represents such a major element of the edible oil industry that it deserves and requires individual comment and critical analysis. It was nationalized only to the extent the corporation bought controlling interest in the then private sector units/companies. That interest was purchased by issuing long-term bonds as compensation. Other than those two events, no pattern exists. The remaining ownership (in varying percentages of 49.999 downwards) remains with a variety of individual and institutional shareholders. Debt obligations are equally divided among a variety of institutions.

There is no pattern to present ongoing ghee plant operations. At the time of nationalization, some expeller operations were also nationalized, along with solvent plant operations, because they were in the same compound. There are some cases where totally unrelated activities were nationalized because they happened to be present. Both financially and operationally, the corporation and its units are diverse and disorganized.

There is continued discussion of efforts to sell several units back to the private sector. Press reports indicated the units to be sold were either bankrupt or in other ways no longer viable. Several other obvious events have occurred which substantially affect prospects for widespread disinvestment:

(a) The plants are now ten years older and from the limited visits made do not appear to have been maintained in the fashion a profit-oriented, investor/owner would have desired.

(b) Labor practices are costly under current management.

(c) The number of staff and labor has vastly increased.

(d) Both (b) and (c) seem irreversible without creating substantial labor unrest and industry disruption.

(e) Given the state of the entire industry and sector noted earlier, with price controls, for example, it seems unlikely the private sector would be anxious to return to the edible oil industry without substantial industry rationalization, and even then probably not by opting to purchase or take back present plants.

For a number of reasons there should be a shift away from ghee to liquid oil. That cannot be accomplished in short order; however, the question must be addressed now as part of a ten-year strategy implementation. Since the conditions and factors that would permit that shift would take several years to occur, the question becomes one of what policy to adopt for the Ghee Corporation at the present time. Given the condition of the plants and the industry, the conclusion is that the GOP has no alternative but to remain in the business. The existing capacity is needed to supply demand and can only be replaced by new capacity, i.e., new plants in the private sector if that sector can be enticed back into the business in a big way. The GOP is now faced with the problem of continual operation, equipment replacement and substantial expenditure to keep the 26 nationalized plants going over the next several years.

A high-level policy decision should therefore be made to rationalize the ghee industry and the GOP's role in it over the next five to ten years. Several steps need to be taken:

(a) If other aspects of the sector can be rationalized, disinvestment/returns to the private sector should be vigorously pursued.

(b) Where (a) is impossible, a tough approach must be made as to which existing units are to be kept going and which are to be shut down.

(c) As a result of (a) and (b), a determination has to be made whether new capacity in ghee or liquid oil should be created to replace closed capacity and whether that new capacity should be public or private.

(d) The suspected size of investment to accomplish (c) and all the other sizeable financial demands of the edible oil sector in the next ten years ought to spur someone into seriously considering private sector involvement, if price anomalies were adjusted and restrictions removed.

AGRICULTURAL MARKETING IN PAKISTAN

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In Pakistan, agriculture accounts for 30 percent of the national income and employs nearly 55 percent of the labor force. Three out of every four persons' source of livelihood and roughly 40 percent of the nation's export earnings come from this sector.

Over the past decade, the increase in Pakistani agricultural output has been enormous. Wheat production has increased from 7.3 MT in 1969/70 to 11.6 MT in 1981/82; cotton from 3 million bales to 4.4 million bales; rice from 2.4 MT to 3.4 MT; and sugarcane from 26 to 37 million tons. This expansion in output understates the amount of produce that the marketing system has had to absorb because the level of marketable surplus also has risen due to the increasing commercialization of farm operations.

The importance of marketing in moving commodities from the producer to the consumer is apparent. It is also important to note that the marketing system has been responsible for the support of agricultural innovations that have enabled the rise in productivity of the past decade. While a great deal has been written about the social, economic and political consequences of Pakistan's ongoing "Green Revolution," relatively little has been said about the nature of marketing institutions and their role in the rural development process.[1]

Marketing institutions vary considerably across Pakistan. The results of a marketing survey conducted in Vehari, Punjab, in February and March of 1983, are presented in this paper. To place these results in a proper context of marketing institutions in Pakistan as a whole, the general structure of Pakistani markets, changes in the marketing system and the nature of demands placed on the system during the past decade are discussed.

The Punjab has the highest ratio of markets to population and the most firmly established system of agricultural and feeder markets. The bulk of the markets are concentrated along the trunk roads that bisect that Province between Rawalpindi and Lahore, Khushab/Sargodha and Lahore, and in the South between Multan and Lahore. Spatially, the agricultural marketing system is characterized by a mild primal city pattern. Multan, Rawalpindi, Lahore, Burewala, Manewala and Faisalabad are well served by markets, especially compared with the more hinterland, barani (dryland) parts of the Province. Compared with Sind and Baluchistan, the Punjab suffers far less from the problems of a single, dominant market center and an underserved, distant hinterland.

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[1]For a recent examination of the impact of the green revolution in Pakistan, see M. Ghaffar Chaudhry, "Green Revolution and Redistribution of Rural Incomes: Pakistan's Experience," Pakistan Development Review, Vol. XXI, No. 3 (Autumn 1982), and the various essays in Robert D. Stevens, et al. (eds.), Rural Development in Bangladesh and Pakistan. Honolulu: The University Press of Hawaii, 1976.

In the subcontinent, one of the consequences of a marketing system characterized by a dominant, single market center is the high ratio of rural villages to market centers. Johnson (1970), in his study of the Indian market system, found that the ratio of villages to markets averaged as much as 300:1.[2] Even in well-served market areas, the ratio of villages (including village colonies) to markets is on the order of 180:1, according to a survey conducted in Vehari in February and March of 1983. The deleterious effects of primal city dominance are, in part, being corrected by the expansion of feeder market networks throughout the Punjab.

In the Punjab there are 300 regulated markets functioning in the notified areas of 122 market committees. There are fifty feeder markets in existence and an additional 121 feeder markets under construction. According to a 1980 census, of 38,074 villages in Pakistan, only 3,816 (10 percent) have grain markets located within 3 kilometers. The largest number of villages (16,160) have grain markets within 19 to 24 kilometers and 5 percent have markets more than 81 kilometers from their villages. Out of a total of 25,420 villages in the Punjab, 2,322 (9 percent) have grain markets within 3 kilometers; 4,970 (20 percent) within 4 to 8 kilometers; 12,061 (47 percent) within 9 to 24 kilometers; and 23 percent more than 24 kilometers from a grain market.[3] In the existing markets, roads, platforms, sewage, shelter, drinking water and other infrastructures are provided by the market committees in their notified market area.

Agricultural marketing in the Punjab is under the administrative control of the Department of Agriculture. An organization headed by the Director of Agriculture (Economics and Marketing) functions under the administrative and financial control of the Government of the Punjab Agriculture Department--through the office of the Director General of Agriculture, Punjab--to oversee the agricultural markets. The directorate is charged with the responsibilities of safeguarding the interests of growers by regulating the sale and purchase of agricultural commodities as specified in the Agricultural Produce Markets Ordinance of 1978. The main responsibilities of the Agriculture Department with respect to agricultural markets are marketing intelligence, new market development, market research, regulation and extension.

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[2]See E. A. Johnson, The Organization of Space in Developing Countries, Harvard University Press, 1970.

[3]Mohd. Akhtar, "Observations on Marketing of Foodcrops in the Punjab," (mimeo), 1983.

The Structure of Food Marketing

There are three different types of agricultural marketing institutions: (1) the state/factory large scale buyers, (2) the regulated agricultural markets and (3) the unregulated or weakly regulated private markets. All three types of markets interact by supplying each other at different times, yet procedurally and organizationally they are distinct.

The state/factory group of marketers comes into the market with a large bulk demand--often a state mandate with associated monopoly procurement power--and, in many cases, a policy mandate to buy directly from the small holder. On the factory side, this would include ginning mills, sugar factories, oil expellers and solvent plants. These operations buy directly from growers as well as from private traders who bulk lots and bring them to the factory gate.

On the government side, a number of corporations and parastatal operations procure and distribute large volumes of essential foodstuffs. The Pakistan Agricultural Storage and Services Corporation (PASSCO) and the Food Department handle wheat procurement and distribution; the Rice Export Commission handles basmati exports; the Cotton Export Commission manages cotton exports; and the Ghee Corporation (GCP) produces and distributes the bulk of the nation's ghee, and to a lesser degree, distributes sugar.

For many of these commodities the government has been moving into the procurement market in a significant way. Wheat procured by the government increased from three percent of the 1971/72 harvest to 29 percent in 1979/80.[4] For cotton and sugarcane, the peak of the government marketing effort came during the nationalization period of the mid-1970's. Since then, however, the government has been active in these markets with price support, stabilization and export efforts.

A number of studies have been written about government marketing efforts that provide a comprehensive description of that system.[5] One point that has been rightfully underscored by many authors is that compared with the private market, the state system appears to be considerably more costly. For example, of a total

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[4]M. Ghaffar Chaudhry, "Pakistan's Agricultural Policy; Lessons from Recent Wheat Policy," (mimeo), 1983, and Chaudhry, "The Operation of the Wheat Market in Pakistan," (mimeo), 1983.

[5]See Carl Gotsch and Gilbert Brown, Prices, Taxes and Subsidies in Pakistan Agriculture, World Bank Staff Working Paper No. 387, April 1980; S. A. Chaughtai, Marketing in Agricultural Products, USAID (mimeo), 1968; and Riaz Ahmad Khan, Issues of Food Distribution in Pakistan, (mimeo), Pakistan Agricultural Research Council, 1982.

government revenue budget of Rs 39.4 billion in 1979/80, the expenditure on input and consumption subsidies for food crops was Rs 6.5 billion. The government's cost of distributing low-quality wheat flour is estimated at Rs 10.7 per 40 kgs while the equivalent private sector cost is estimated at Rs 9.07--an eighteen percent difference without accounting for quality difference in the final product.[6] In the state ghee sector, plants operate with six times as many laborers as do the private plants. Prenationalization plant owners estimate they could run the facilities at a 25 percent lower cost than the state does.[7]

There has been no exhaustive comparison of state versus private marketing costs for all the controlled food commodities; yet from fragmentary evidence, it does appear the nation is bearing a high cost for state control of marketing. In all fairness, however, the ends of the state marketing system, such as the provision of an adequate diet and national food security, are at times simply incompatible with profit maximization in trade.

The regulated markets are those covered under the Agricultural Markets Ordinance of 1978, in the domain of an established market area under the administrative control of a market committee and have a regulated schedule of fees and charges. The regulated markets, or mandies, are divided into three classes, depending on the amount of revenue generated by the controlling market committee. These classifications are revised periodically as the committee revenues rise, but generally the largest, most active markets are class A and the new, untested markets are class C. Anything in between receives a class B distinction.

There are regulated mandies for cattle, buffalo, goats, sheep, fruit and vegetables and grains. In the large cities there are also regulated markets for fish. Except for the fruit and vegetable (subzi) mandi and the grain mandi, all the others are periodic markets where direct sale is used as the medium of exchange. Generally, the fruit and vegetable and grain mandies are the largest and most actively controlled of the regulated markets. The grain mandies are nearly all constructed along a similar pattern with a wide ring of thirty (Gaggo mandi) to one hundred and fifty (Multan mandi) shops around a set of offices, a mosque, a watering stand and a drying platform. Each shop is two or three stories high with the bottom floor used for business and the top for housing. Each shop generally has one or two large (5-ton) storerooms and a front office room. Each office has at least a low, wooden bed (which serves as a working space), a safe

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[6]M. Ghaffar Chaudhry, *Ibid.*

[7]USAID, Edible Oils Study, Project Papers, Islamabad, 1983.

markets. They also operate on an auction rather than a direct sale basis.

and a telephone. The head of each shop is the arthi or commission agent.

There are two types of arthis, commonly called kacha and pacca. A kacha arthi is a dealer who trades in agricultural commodities, primarily on a commission basis, while a pacca arthi carries out the functions of a kacha arthi but also trades commodities on his own account. A kacha arthi, for example, would be in a financial position to arrange sales of a particular commodity to government procurement centers or to other terminal markets using his own funds to cover the purchase cost.

The arthi advances loans to farmers who repay the principal and market their produce through him. The loans advanced by arthis are fairly small--on the order of Rs 3,000 to Rs 5,000--and are given for both agricultural production and personal needs. Arthis assist farmers in finding seeds and fertilizers and also arrange for pick-up of crops from good clients. After harvest, the crop is delivered to the arthi's shop. The arthi then supervises the auction of the commodity. If the farmer is not satisfied with the auction price, the sale is voided and the goods are auctioned again. The official commission fee at an auction is 3.12 percent to the arthi. Portions of this go to the weighman (pallydar), the auctioneer (dhalal), and office costs.

The open auction generally serves more as a means of quality grading than of open price competition as buyers are often in touch with neighboring markets. The buyer at the auction pays a fee to the market committee on each sale; the amount of the fee depends on the type of produce bought. Although the auctions are technically "open," there is a great deal of price collusion. Also, in practice, the arthi's fees generally exceed the fixed commission charges due to underweighing and additional, unrecorded charges.

Although the regulated markets were established to ease the marketing position of the growers, the primary user of the facilities are beoparis, or middlemen. There are two classes of beoparis: those who live and work in villages around the market and those who trade between markets. The village beoparis will bulk lots of produce and arrange shipment to the market. The beopari will attach himself to one or possibly two arthis and through them sell his goods. The beopari will also obtain the bulk of his working capital in loans from the arthi and generally, will run a continuous debt in his arthi's shop as sales and loans are recycled.

The market beopari works as a middleman between markets and between factories and markets. He also works with each market where he does business. The market beopari is often on the telephone determining prices in terminal markets, checking procurement orders at the government purchase centers and arranging shipment between markets. These beoparis also operate on a credit basis, but unlike their village counterpart, take higher

risks, suffer losses more often and get a greater return from the trade.

The arthis are technically governed by a market committee, an elected body of growers and traders. In practice, a marketer's association (anjuman arthi) of all the arthis in the mandi serves as the medium for settling disputes and handling minor problems with government authorities. The anjuman arthi have almost no budget, but due to the support of the arthis, have the power to mediate in disputes and establish codes of ethics. The committees, by comparison, have large budgets and strong ties to the local government because the marketing deputy of the district agriculture department is a mandatory committee member. However, they have very little real control over the practices of the arthis.

The market committees collect the market fees, inspect the weights and measures of the trader, post current food prices, maintain and develop market facilities and issue licenses. Licenses are issued to arthis, beoparis, various market funtionaries (weighmen, auctioneers, sweepers, and baggers), those who operate small retail shops (Karyana merchants), those who sell in wholesale markets (dukandar), and to a lesser degree, village shopkeepers (hatiwalla). In addition to administering and operating out of the main grain mandi of a market town, the market committee will administer the local subzi mandi and any feeder markets attached to the main grain mandi.

In the fruit and vegetable (subzi) mandies, operations are basically the same as those in the grain mandi. However, in the subzi mandi, trade is primarily a morning affair as great pains are taken to move the produce before the day becomes too hot. Also, trade in the subzi mandi is less dependent on the advance of credit to growers. For a fruit and vegetable grower, a quick sale when prices are high tends to be more important than the provision of credit. Accordingly, subzi arthis build up good will by bringing together farmers and buyers at appropriate times.

At the subzi mandi, beoparis often will advance credit to push-cart operators, rehriwala, who rent a cart and buy a lot of fruit in the morning, sell the fruit during the day and repay the beoparis the next day. There are also khoka (small stallholders) who have regular stalls scattered throughout the city. In both cases, the rate of interest these vendors pay for the produce loan is fairly high--on the order of three to five percent per day--and reflects the high risk taken in advancing such short-term loans.

The rehriwala are part of the unregulated market system. They and the encroachers who set up stalls in the mandies are considered a source of urban congestion and unfair competition to the regulated arthis because they pay no market fees, avoid licenses and have a negligible overhead. As a group, they are difficult to control and, in many of the smaller towns in the Punjab, may

actually handle a greater volume of produce than the arthi.

The most important form of unregulated marketing, however, is outside the towns on the crossroads dividing the village roads from the main metalled roads. At these crossroads, a group of beoparis will set up a small row of shops called an adda, where they will buy produce from farmers and sell it directly to government procurement centers or to factories. Because there is no regular supervision of these centers, underweighing of produce is a common complaint, but since no sale commission or market fee is paid, growers frequently receive a higher unit price for their goods than they would receive at the mandi.

In many respects, the increase in food marketing activities by the government has fostered the growth of unregulated markets and village beoparis at the expense of established mandies. As discussed earlier, the government does operate procurement and distribution services for wheat, rice, sugar, cotton and edible oils—the mainstays of the Pakistani agricultural economy (see Table 1). To a lesser extent, the government also trades in potatoes and onions. For all these crops the government defends

Table 1

Government Wheat Procurement and Total Wheat Production in the Punjab 1972/73 to 1981/82

Year	Production	Procurement	% Procured of Total Produced
1972/73	5694	120	2
1973/74	5665	1122	20
1974/75	5786	826	14
1975/76	6571	894	14
1976/77	6808	1789	26
1977/78	6090	1231	20
1978/79	7324	424	6
1979/80	7914	1242	16
1980/81	8350	1614	19
1981/82	--	2148	--

Source: Bureau of Statistics, Government of the Punjab, Punjab Development Statistics, 1981.

a floor price, and for wheat in particular, the government manages a food subsidy program to ensure an adequate diet. The private controls and procurement programs operated by the government buffer the private food markets and replace them when procurement is done directly by the government. Hence, the encroachment on the private, regulated marketing system is done

on two fronts: first through pricing channels and second through direct replacement.

One of the areas where technological advancement (as opposed to institutional advancement) has affected food marketing is in the change in transport facilities. While the number of kilometers of railways nationwide has stayed constant at approximately 8,300 since the early 1970's, the total number of kilometers of roadways has more than tripled--from 30,000 in 1969/78 to slightly more than 96,000 in 1979/80 (see Table 2). More important than the expansion of roadways, however, has been the large-scale adoption of tractors.

Table 2

Development of Transport Facilities in Pakistan 1960/61 to 1980/81

Year	Railway1 (1000 km)	Roadways2 (1000 km)	Tractors Imported (Cumulative No.)
1960/61	8.6	32.8	-
1961/62	8.6	33.8	-
1962/63	8.6	33.8	-
1963/64	8.6	34.4	-
1964/65	8.6	35.0	-
1965/66	8.6	35.5	-
1966/67	8.6	30.5	-
1967/68	8.6	31.7	-
1968/69	8.6	30.6	21,534
1969/70	8.7	31.7	27,231
1970/71	8.6	32.5	31,109
1971/72	8.6	34.7	35,333
1972/73	8.8	35.8	37,180
1973/74	8.8	38.9	42,396
1974/75	8.8	38.6	49,586
1975/76	8.8	49.8	60,395
1976/77	8.8	51.1	75,949
1977/78	8.8	93.43	87,851
1978/79	8.8	95.2	103,029
1979/80	8.8	95.7	121,952
1980/81	8.8	96.5	136,254

[1]Total route kilometers.
[2]Total roads includes high and low type roads.
[3]Includes village roadways in districts. These are not included in the earlier estimates.

Source: Government of Pakistan, Pakistan Economic Survey, 1980-81, and Bureau of Statistics, Government of the Punjab, Punjab Development Statistics, 1981.

Tractors are primarily used for agricultural production purposes in Pakistan, although an important secondary source of revenue from the ownership of the tractor is hauling goods to the market. As a farm-to-market transport device, tractors are highly cost-effective, competing very well with bullock carts and trucks. In the Punjab, the number of tractors owned in 1968 was 13,764. By 1975, this had more than doubled to 27,329. In the nation as a whole, a cumulative total of 21,500 tractors had been imported by 1968. By 1979/80, the total number of tractors imported was just under 122,000.[6]

In certain parts of the Punjab, shipping agents claim small trucks cannot compete with tractors for hauling the products of large farmers. For the marketing system as a whole, tractor-transporters have kept a lid on transport costs, opened up areas previously difficult or expensive to reach and have exponentially increased the number of transport outlets for particular growers. Farmers who own tractors also find it easier to bypass the mandi because they can market their produce directly to factories and government procurement centers whenever they please. The ability of the arthi to arrange transport of goods to the market no longer commands the premium it once did.

Another factor that has contributed in recent years to a diversification of marketing activities from the regulated mandi to the unregulated markets and government procurement centers has been the spread of institutional credit. Loans from the Agricultural Development Bank, Cooperative Bank and the nationalized commercial banks have increased from 155 million rupees in 1969/70 to 4.6 billion rupees in 1980/81.[7] Interest rates for agricultural loans have been held low through State mandate. For several commercial banks there is a policy of no-interest agricultural production loans that are internally subsidized by the State Bank. The institutional loans have been known to suffer from malpractice in disbursement and high rates of default, yet through government support they have managed to grow at a remarkable rate (see Table 3). The great increase in the volume of institutional credit and the development of mobile credit centers in the villages have done a great deal to temper the power of the arthi as the sole loan giver.

Although large-scale institutional buying, price regulation, tractorization and the spread of institutional credit have acted to capture market activities previously held by the arthis, the damage done to the regulated mandies has been relative rather than absolute. In absolute terms, the volume of business in the domestic food market has grown enormously. The cessation of wheat imports and the expansion in wheat production from 7.3 MMT

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[6]Government of Pakistan, Pakistan Economic Survey, 1980/81.

[7]*Ibid.*

in 1969/70 to 11.3 MMT in 1981/82 has put an additional three to four MMT of wheat alone in the hands of the domestic traders.

Table 3

Development of Institutional Credit
in Agriculture 1971/72 to 1980/81

Year	Total Agricultural Credit[a] (Million Rupees)
1971/72	128
1972/73	307
1973/74	912
1974/75	1,010
1975/76	1,458
1976/77	1,717
1977/78	1,868
1978/79	2,223
1979/80	3,009
1980/81	4,686

[a]Total agricultural credit includes Agricultural Development Bank of Pakistan loans, Taccavi loans, Cooperative Bank loans and commercial bank loans.

Source: Government of Pakistan, Pakistan Economic Survey, 1980/81.

The expansion in the business of the regulated mandies is reflected in revenues paid to market committees. In 1982/83, market committee total revenues in the Punjab were estimated at 143 million rupees. In 1967/68, market committee incomes, in nominal terms, were roughly eight million rupees (see Table 4). Even after discounting for an inflation of roughly 330 percent over this period, it is still apparent that real market committee revenues have more than tripled in fifteen years. These estimates are most likely biased downwards due to persistent problems in under-collection and under-reporting of market fees. Nonetheless, there is no reason to suspect this bias is any greater in 1982 than it was in 1967. Accordingly, the volume of trade has been that much greater in 1982 than in 1967.

Table 4

Punjab Market Committee Income
in 1967/68 and 1982/83

1967/1968		1982/1983	
Division	Total Income (100,000 Rs)	District	Total Income (100,000 Rs)
Multan	31	Lahore	270
Sargodha	18	Sheikhupura	52
Lahore	26	Okara	31
Rawalpindi	2	Kasur	77
Bahawalpur	6	Gujranwala	162
		Sialkot	59
TOTAL	83	Gujrat	25
		Rawalpindi	22
		Attock	10
		Jhelum	12
		Sargodha	32
		Khushab	70
		Mianwali	4
		Faisalabad	134
		Shang	29
		Toba Tek Singh	26
		Multan	110
		Sahiwal	43
		Vehari	57
		Dera Ghazi Khan	9
		Muzaffargarh	42
		Rajanpur	21
		Leiah	9
		Bahawalpur	62
		Bahawalnagar	53
		Rahimyar Khan	59
		Bhakhar	7
		TOTAL	1,487

Source: Marketing Director, Department of Agriculture, Government of the Punjab, 1983.

The strength of the regulated mandies and of the arthis themselves lies in their flexibility. The ability to grasp a new situation by understanding it and then establishing a remunerative expertise within the new confines has kept the arthis in business. For example, in areas where the regulated mandies have been hurt badly by competition from the unregulated sector and the government, the arthis have been quick to take on dealerships for the distribution of fertilizer and pesticide. As agents for agrochemical concerns, it is in their best interest to assist their clients to obtain agricultural loans. Consequently, some arthis are even helping farmers obtain loans from the banks so that they can buy their fertilizer or pesticide from them. Second, arthis and market-beoparis are making a business out of procuring commodities for the government. While technically illegal, many beoparis and a smaller number of arthis specialize in braving the wave of bureaucratic procedures to sell food to the government.

A great deal of the flexibility of the traditional trade sector is not captured by current debates on Pakistani agricultural marketing. Contemporary analysis of food marketing in Pakistan has been divided between what can be termed microlevel institutional analysis and macrolevel efficiency analysis.

The microstudies have tended to concentrate on the differences between the purported and the actual organization of trade. For example, a study by Yasin, et al. (1976), on agricultural marketing in the Punjab found that market imperfections were primarily the result of the farmers' lack of knowledge, inadequate regulation and problems in enforcing dispute settlements. Yasin also found that retailers were taking a high margin (43 percent) on the sale of pulses and that the size of the margin was proportional to the number of intermediaries involved in the trade. A study by Chaudry, Khan and Rauf on agricultural marketing in the Sarghoda Division found an absence of proper grading in the marketplace; price collusion between traders; charges exceeding the commission commonly demanded; delayed payments after a commodity sale; and, in general, poor performance of the agricultural markets due to an incomplete enforcement of the Agricultural Marketing Order.

Rashid (1971), in a study on price formation in wheat markets, found that private negotiation between buyer and sellers was the primary means of arranging a sale rather than through an open auction. This was to the disadvantage of the grower and also relatively time consuming compared with an open auction. In an earlier study, "Economic Aspects of Distributive Margins" (1970), he found that the reason for a large number of intermediaries in the distributive trade was lack of finance at various trade levels and the risk attached to marketing the agricultural produce.

According to a study by Siddiqui of agricultural marketing in the Sind, part of the reason for the high marketing margins on fruit, vegetables and pulses was central market dominance in price

formation that gave rise to predetermined terminal prices. In a study of barani area food marketing in the Punjab and NWFP, Ali, Cheema and Ahmad (1979) determined that trade malpractices, particularly improper weighing and price collusion, are a major impediment to efficient market development.

On the macroside, several authors have found that farmers--even those who produce primarily for their own subsistence needs--are sensitive and responsive to market price signals. Falcon (1965), Cummings (1975), Qureshi (1974), Gotch (1980), Aslan (1978), Ashiq (1981), Hussain (1965) and Krishna (1963) have, on the basis of various forms of econometric analyses, concluded that the Pakistani farmer exhibits a behavioral response to changes in the market prices. Sarfraz Qureshi (1974), in a study on the performance of village markets, finds that:

> . . . prices in the village and primary markets were highly correlated. The intermarket price differences were generally less than the transfer costs between the markets. The marketing margins in the wholesale primary markets were unrelated to the prices in the markets, indicating the price increases were passed on to the farmers. This evidence strongly supports the hypothesis of competitiveness in the agricultural markets.

In a study of agricultural price behavior in the Punjab by Delawar Ali Khan and Qamar Jabeen, the authors found there was considerable seasonal variation in prices for wheat, rice and maize, but that government procurement efforts appear to have tempered the seasonality of wheat prices to a great degree.

On balance, the literature of agricultural trade seems to focus on what appears to be price competitiveness from the top and antisocial collusion by a bloated chain of intermediaries at the ground level.[10] Both forms of analysis are useful. From a policy making vantage point, macrolevel price analysis is needed in defining price supports, procurement targets and so forth, while from the microvantage point. an understanding of the darker side of market practice can help define measures to improve

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[10]For margin comparisons see Peter F. Bell and Janet Tai, "Markets, Middlemen and Technology," Malayan Economic Review, Vol. 14, April 1969; Leon Mears, The New Rice in Indonesia, Gadjah Mada University Press, 1983; S. Tabor and Dale Squires, "Marketing Margins of Secondary Crops in Indonesia, Ekonomi dan Keuangan Indonesia, September 1982; Uma J. Lele, "The Traders of Sholapur," in John Mellor, et al., eds., Developing Rural India, Cornell University Press, 1968; and Paul Bohannan and George Dalton's collection on African Marketing systems, Markets in Africa, Northwestern University Press, 1962.

actual market practice. More importantly, the microlevel analysis can also help in understanding why price signals do not reach the farmgate and what can be done institutionally to improve the transmission of pricing signals to the farm community.

Bearing in mind the need to bridge the gap between the micro approach and the macro questions, a study in Vehari was initiated. The objective was to explore the marketing sector from a multi-level interview process and try to address several pressing questions about market structure and operation.

The Research Site

In November, 1982, when the present study was initiated, food was moving to the markets and there were no signs of shortages, so by some accounts, there were no marketing problems. However, the complexity of the marketing operation, the apparent marriage and rivalry of state and private trading concerns and the appearance of waste and malpractice in the market dictated further inquiry.

A marketing survey was conducted in Vehari, Punjab, in February and March, 1983. Interviews were held with 50 farmers, 35 commission agents (arthi), 35 middlemen (beopari) and 35 small shopkeepers and wholesalers (karyana and dukandar). Farmers were randomly selected from five village clusters at varying distances from the district markets. Interviews with traders were conducted in three towns within the district--Vehari, Burewala and Gaggo--with 90 trader interviews conducted in the first two towns and 15 in the third. Interviews were also conducted with those in the bureaucracy and private sector who were involved in district food trade. This included representatives from the district and local government, the food processing sector, credit institutions, cooperatives, the storage sector and various state trading corporations. The combination of survey material and semistructured interviews allowed for a well-rounded picture of this most important sector.

The district of Vehari is composed of three subdistricts (tehsils)--Vehari, Burewala and Mailsi. It is fertile, located in the heart of the cotton belt between Multan, Sahiwal and Bahawalnagar, with water flowing in through the Pakpatten canal from the Sutlej. The major crops in the district are wheat, cotton, sugarcane and rice, although there are also a fair amount of orchard crops, vegetables, oilseeds and melons. Table 5 indicates that approximately 470,000 acres of land is planted in wheat, 400,000 in cotton, 64,000 in sugarcane and 37,000 in rice. Acreage in rice has declined marginally in the past five years, while that in cotton, wheat and sugarcane has grown slightly. In 1980/81, 13 percent of the Punjab's cotton production and six percent of the wheat production came from this district. Almost all, except for the northern rim of the district, is irrigated by canals and tubewells. By the standards of the Punjab, the

Table 5

Showing Tehsil-wise Area, Production and Average Yield in Vehari District

S. No.	Name of Tehsil	Name of Crop	1976-77 Area[1]	1976-77 Production[2]	1976-77 Average Yield[3]	1977-78 Area[1]	1977-78 Production[2]	1977-78 Average Yield[3]	1978-79 Area[1]	1978-79 Production[2]	1978-79 Average Yield[3]
1.	Vehari	Wheat	132.535	113.52	21.41	122.272	94.038	19.22	136.266	110.568	20.28
	Burewala	Wheat	130.664	111.8	21.39	133.391	102.276	19.16	132.221	107.316	20.29
	Mailsi	Wheat	125.738	107.606	21.39	137.337	105.352	19.17	145.513	117.952	20.26
	Total of District:		338.935	332.928	21.40	393.000	301.666	19.19	414.000	335.836	20.28
2.	Vehari	Cotton	103.621	64.742	9.37	90.758	59.551	9.84	98.025	63.014	9.64
	Burewala	Cotton	72.029	45.257	9.42	77.487	50.958	9.86	80.733	51.536	9.57
	Mailsi	Cotton	151.341	94.916	9.40	142.758	93.923	9.86	149.242	95.907	9.62
	Total of District:		326.991	204.915	9.40	311.003	204.432	9.86	328.000	210.357	9.62
3.	Vehari	Sugarcane	15.565	245.88	394.92	15.466	262.968	425.06	18.268	293.58	401.76
	Burewala	Sugarcane	18.347	295.096	402.10	19.800	333.092	420.39	18.481	993.59	397.13
	Malisi	Sugarcane	8.095	131.136	404.99	12.663	210.375	415.32	9.705	146.613	378.18
	Total of District:		42.007	672.112	400.00	47.937	806.435	420.57	46.454	733.973	395.00
4.	Vehari	Rice	16.82	13.184	19.59	19.321	12.995	16.91	24.552	16.344	16.64
	Burewala	Rice	18.463	14.832	20.08	20.644	13.679	16.56	22.568	14.982	16.59
	Malisi	Rice	6.724	4.952	18.41	11.926	7.525	15.77	11.936	7.509	15.72
	Total of District:		42.007	32.968	19.62	51.911	34.199	16.47	59.056	38.835	16.44

S. No.	Name of Tehsil	Name of Crop	1979-80 Area[1]	1979-80 Production[2]	1979-80 Average Yield[3]	1980-81 Area[1]	1980-81 Production[2]	1980-81 Average Yield[3]	1981-82 Area[1]	1981-82 Production[2]	1981-82 Average Yield[3]
1.	Vehari	Wheat	144.81	123.55	21.32	142.0	138.824	24.44	138.5	143.986	25.99
	Burewala	Wheat	133.593	113.981	21.32	146.0	142.642	24.42	148.57	154.364	25.97
	Mailsi	Wheat	163.597	139.691	21.34	162.0	158.274	24.42	186.342	193.998	26.02
	Total of District:		442.000	376.938	21.32	450.0	439.740	24.43	473.412	492.348	26.00
2.	Vehari	Cotton	103.515	86.426	12.52	104.564	90.336	12.96	110.663	102.960	13.95
	Burewala	Cotton	81.343	67.959	12.53	87.163	75.603	13.01	93.936	88.920	13.90
	Mailsi	Cotton	162.142	135.938	12.57	168.273	146.022	13.01	184.8	172.283	13.96
	Total of District:		347.000	290.323	12.55	360.000	312.001	13.00	391.399	364.263	13.96
3.	Vehari	Sugarcane	19.127	341.817	446.77	22.5	387.442	430.49	22.91	404.052	440.91
	Burewala	Sugarcane	19.047	341.817	448.64	21.299	369.531	434.09	23.91	422.418	455.38
	Malisi	Sugarcane	9.269	161.915	436.71	17.976	299.401	416.38	17.15	512.222	455.13
	Total of District:		47.443	845.545	445.56	61.775	1046.674	427.63	63.97	1138.692	445.01
4.	Vehari	Rice	24.054	16.751	17.41	16.572	10.352	15.61	16.2	9.488	14.64
	Burewala	Rice	17.088	11.865	17.36	11.96	7.123	14.88	13.591	7.709	14.18
	Malisi	Rice	9.76	6.324	16.19	5.597	3.235	14.44	7.019	4.152	14.78
	Total of District:		50.902	34.94	17.16	34.129	20.71	15.17	36.81	21.349	14.50

[1]Area = Acres (000).
[2]Production = (000) M/Tons/Bales.
[3]A/Yield = in Maunds/Acres.

district is regarded as technically progressive in terms of the rate of tractor adoption and new tubewell construction.

Vehari is also commonly considered a district of large landowners and small tenants. In the tehsil of Vehari and the tehsil of Mailsi, more than half the land is in holdings of over 25 acres (see Table 6), while in Burewala, more than 4 percent is of that size. In the Punjab as a whole, 52.5 percent of the farm area is in holdings that are over 25 acres (see Table 7). As far as the figures are comparable, land distribution, according to plot size, puts Vehari near the mean of the Punjab.

Table 6

Distribution of Landholding in Vehari, Punjab, 1981

Name of Tehsil	Size of Holdings (Acres)	Number of Holdings	Acres Owned	Percentage of Total Ownership
Vehari	1 to 12-1/2	47,648	167,654	4
Mailsi	" " "	43,728	142,851	3
Burewala	" " "	53,565	156,908	3
Vehari	12-1/2 to 25	2,758	54,686	20
Mailsi	" " "	4,840	73,581	16
Burewala	" " "	4,267	66,965	16
Vehari	above 25	1,474	83,552	57
Mailsi	" "	2,261	125,013	55
Burewala	" "	1,126	49,148	44

Source: Department of Agriculture, Vehari, 1983.

Table 7

Land Distribution in the Punjab and in Pakistan, 1979/80

Farm Size (hectares)	---Thousands of Farms---- Pakistan	Punjab
Under 2.02	1,059	619
2.02 to under 5.06	1,501	926
5.06 to under 10.12	794	549
10.12 to under 20.24	289	209
20.24 to under 60.72	103	65
60.72 and above	16	7
TOTAL	3,762	2,375

Source: Bureau of Statistics, Government of the Punjab, Punjab Development Statistics, 1981.

On the lower end of the scale, 92 percent of the holdings in the tehsil of Vehari, 86 percent of the holdings in Mailsi and 91 percent of the holdings in Burewala are under 12.5 acres, the common cutoff used for small holders in Pakistan. The estimated number of farms under 12.5 hectares in the Punjab is 23 percent of the total. It follows then that Vehari is a district of many small holdings, with the majority of the land in the possession of a small group of large landholders. Data on tenancy and rental arrangement is not available for the district, but most likely would confirm the characterization of the district as one of large landowners and many tenants.

Neither the agronomic abundance nor the distributional disparity were the major reasons for choosing this district as a sample location. The primary reason was the nature of the marketing institutions located there.

There are four main markets in the district and three were sampled in the survey. The first, in Burewala, is a grain market (mandi) and green market (subzi mandi), which is well integrated into all the major national markets, particularly for sugar and sugar products. The second market, in Gaggo, was established in the mid-1960's as a feeder market to the Burewala mandi. The market has taken on a life of its own, however, and has become both a feeder market and a small regional market for wheat, cotton and sugar. The market in Vehari dates back to Partition but, due to competition from the other markets in the district, has seen a sharp reduction in the amount of business in recent years. To compensate for the decline in sales, traders have become agents for fertilizer and pesticide companies, and many obtain the bulk of their income from these activities rather than from trade in agricultural commodities.

Observations

From discussion and observation in the marketplace in Vehari, one is led to conclude that, as an economic group, private traders are not the speculative, wealthy, antisocial lot they are often made out to be. Margins are held down through competition and from the fixed prices at which the government procures. Recently, as subsidies have been reduced from agricultural inputs, and as floor prices have been raised at sub-inflation rates, there has been pressure on marketers to reduce their margin. This has led to reduced margins and also to a great deal of open animosity between the traders and the various concerns that procure foodstuffs for the government.

In the survey of 35 Aparis (middlemen), it was found that the average percent markup on all sales was 11 percent, the maximum 29 percent and the minimum 6 percent. After transport costs are deducted, the margins are cut in half. In comparison with margin estimates from other nations, these appear fairly low and appear to reflect a high degree of competition in the marketing sphere.

One is aware in small towns that marketers are, by and large, middle class in their lifestyle. Few marketers reported owning a car, while only one-quarter of them had motorbikes. The reported income of the marketers, although liable to modest underestimates, is as follows:

Type	N	Average Income (Rs/month)	Maximum	Minimum
Arthi	35	4,182	12,000	800
Beopari	36	2,914	8,500	900
Dukandar	35	2,480	12,000	500

These figures also reflect the earnings' hierarchy of the traders. A small retailer is generally poorer than a middleman who is himself poorer than a commission agent. The earnings for the arthi are on the order of Rs 4,000 per month which is high by Pakistani averages, but not at all representative of upper-class elite salaries.

Results

The Arthi

The average arthi in Vehari has been in the business for 22 years, entering the trade overwhelmingly through an in-family apprenticeship. The arthi is both a borrower and lender--borrowing about 40,000 rupees and, in a season, lending slightly more than twice that amount in small lots of 500 to 7,400 rupees. One-third of the arthi rent their shop facilities and only 10 percent of those sampled will accept payment in kind for their goods. The formal education of an arthi is rather limited, averaging 4.6 years in our study. Yet skill was considered by nearly all the arthis as the main reason for success; for the arthi, skill is more the result of years of well-managed connections than of formal training.

Income for the arthi is highly dependent on the amount of credit that can be supplied. Using ordinary least squares regression analysis, it was found that the total loans advanced by an arthi in a season explained 40 percent of the variation in arthi income and was, as expected, positively related to trader income. At the same mean, the elasticity between trader debt capacity and income was .3 (see Table 8).

Table 8

Regression Results for the Arthi

(1) $Y = 2.91 + .013TL + E \quad R^2 = .39$
(.03)*

(2) $TL = -24.6 + 17.5AVL + .94GR + E \quad R^2 = .49$
(9.7) (.21)

Y = income per month (1,000 Rs).
TL = total credit advanced per season (1,000 Rs).
AVL = average loan advanced (1,000 Rs).
GR = gross sales per month (1,000 Rs).

*Standard errors in parentheses, estimates from ordinary least squares regression analysis, N = 34.

The total amount of capital advanced by an arthi can be partly explained by the size of his average loan and by the gross business he does. It follows that the larger the average loan advanced by a trader, the greater his total debt capacity. His business gross will be an important source and determinant of his debt capacity (see Table 9).

Table 9

Arthi-Survey---Descriptive Statistics

	Variable	Sample Mean	Sample Standard Deviation	Minimum	Maximum
1.	Income/month ('000 Rs)	4.1	2.5	.8	12
2.	Years in business	22	13	1	50
3.	Average loan ('000 Rs)	3.0	4.7	0	7.5
4.	Total loans per season ('000 Rs)	93	119	0	600
5.	Storage size (kg)	760	1,089	0	6,000
6.	Greatest debt ('000 Rs)	41	72	0	320
7.	Formal education (years)	4.6	4.7	0	13
8.	Gross business/month ('000 Rs)	69.7	80.1	5	400
9.	No. of customers/ farmers	191	65.2	100	350

The Beoparti

Table 10 shows that the average beopari in Vehari had an income of close to Rs 3,000 per month. Market beoparis had higher incomes than village beoparis, although those from the village had part-time employment, primarily in farming, that partially offset the difference. Margins for the beopari averaged nine percent of the sale of the commodity in which they most often traded. The average beopari gets almost a sixth of his income from non-trade work. An average in this context is somewhat deceiving because village beoparis obtain a far higher portion of their income from non-trade activities than do market beoparis. The average beopari has been working at his trade for 12 years, slightly more than half the time an arthi has been involved with the trade. By this measure, beoparis can be considered to be less established than the arthi.

Table 10

Beopari Survey--Descriptive Statistics

	Variable	Sample Mean	Sample Standard Deviation	Minimum	Maximum
1.	Income/month (Rs)	2,914	1,896	900	8,500
2.	Years in business	12.7	10.3	2	45
3.	Margin (% on most frequent sale)	9.2	4.1	3.2	20
4.	Village/market status (0-village, 1-market)	.4	.49	0	1
5.	Period of delay in payment (days)	10	11.1	0	60
6.	Greatest loss ('000 Rs)	12.8	17.4	0	80
7.	No. of customers/week	22.9	13.5	7	60
8.	Largest outstanding debt ('000 Rs)	28.5	67.0	0	400
9.	Household size	7.7	2.8	0	16
10.	Other income/month ('000 Rs)	522	486	0	5,000

Many beoparis have taken on the role previously held by the arthi. Nearly all extend credit to traders and arrange for the sale of goods to government centers and private mills. As the beopari fills many of the classic middlemen risk-taking positions, he must be prepared to suffer a loss. All except two beoparis (n = 36) admitted suffering a loss at some point in time. Several traders stated the ability to absorb a loss is a major determinant of the success of the beopari.

Using regression analysis, 60 percent of the sample variation in beopari earnings could be explained by the variation in the number of years the beopari had been in trade, his status as a village or market beopari, his largest debt, the number of customers he had per week and his part-time income. The regression results are as follows:

$$Y = 1654 - 31.4Y + 12.9LD + 18.4CU + 1.10YO + 705UI + E$$

Std. error:

(22.5) (3.4) (16.4) (.23) (475)

R^2 = .62
N = 34
Y = income/month (Rs)
BUS = years in business
LD = largest outstanding debt (1,000 Rs)
CU = number of customers/week
YO = other income/month (1,000 Rs)
UI = 0 = village beopari; 1 = market beopari

At the mean, the elasticity estimates for the explanatory variables are as follows:

Variable	Elasticity with Respect to Monthly Income
BUS	-.14
LD	.13
CU	.14
YO	.20

Hence, traders' incomes are fairly inelastic with respect to their years in business, debt status, number of customers and other income. It is not very surprising that the length of time in the business is inversely related to total earnings because this is a class of newer traders who enter the business for the quick returns. Those who cannot afford the losses tend to drop out, while those who continue choose a risk management strategy that provides them with an assured, if relatively low, income.

A major integrating factor in the marketplace is the indebtedness relation between the arthi and the beopari. In the Burewala market (but not in the other two markets studied), payments from the arthi to the beopari are made three times per month--on the 4th, 14th and 24th. It is in the arthi's best interest to withhold payment from the beopari as long as possible so that he is assured the beopari will beome a regular customer. For the beopari, late payment is also, up to a point, advantageous. He obtains the bulk of his working capital from the arthi and

accordingly must maintain good relations with him. Also, depending on the wishes of the arthi, a beopari may use his facilities, such as the telephone, at cost or at no charge--a difference of as much as Rs 300 per month.

The average delay period for payment was 10 days, with a maximum of two months reported. Practically all the beoparis reported some delay in payment from the arthi, and this was considered a normal if not a healthy business practice. On the other hand, farmers frequently complained about delayed payments from arthis because they had post-harvest debts to settle (in addition to the debt with the arthi) and because of the nuisance involved in making a return visit to the market. The ability to absorb or to manage delay in payment appears to be critical to the role of the beopari in the market.

Dukandar/Karyana

Wholesalers and food retailers in the Punjabi towns tend to operate partly as an unofficial arthi and partly as a food wholesaler or retailer--whichever the case may be. They borrow and buy from arthis in the mandi, but at the same time they extend loans to good customers in exchange for marketing guarantees. Much of the dukandar/karyana business is very transitory, especially in comparison to that of the arthis.

Entry into these professions is far more open and less tied to family heritage than is that of the commission agent. At the same time, returns are fairly low for the small-town wholesaler and retailer. The average reported income was Rs 2,480 per month which, when spread over an average eight-member household, leaves very little discretionary spending. The average food merchant (dukandar and karyana) has been in business for under eight years and has an average of six years of formal education. Most enter the business through a family connection, yet a high percentage simply buy their way into the trade.

For a town food merchant, income is partly a function of education, the number of customers served and the amount of supplementary or non-trade income available to the trader. Using ordinary least squares regression analysis, the following recursive income equation was estimated:

$$Y = 1033 + 178.6ED + 9.8CUS + 1.5\ IO + E$$

Std. error:

(73.3) (2.98) (.53)

R^2 = .48
N = 35
Y = income/month (Rs).
ED = years of formal education.
CUS = number of customers/week.
IO = non-trade income/month (Rs).

At the mean of the sample, the elasticity estimates are:

Explanatory Term	Elasticity with Respect to Income
ED	.45
CUS	1.15
IO	.17

It is interesting to note that the income of a food merchant is elastic with respect to the number of customers he has. In the urban food retailing sector in particular, there is a great deal of competition and animosity between those who have established shops and those who work as squatters, selling for a few days and then moving to a new location. The elastic response of income to the number of customers explains the desire of the more established businessman to limit his competition (see Table 11).

Table 11

Dukandar/Karyana--Descriptive Statistics

Variable	Sample Mean	Sample Standard Deviation	Minimum	Maximum
1. Income (Rs)	2,480	2,494	500	12,000
2. Household size	8.3	2.8	3	16
3. Education (years)	6.3	4.9	0	21
4. Years in business	7.7	7.2	.25	35
5. Inventory value (1,000 Rs)	30.8	32	0	150
6. Sale margin (highest %)	15.2	19.9	0	80
7. Greatest debt (1,000 Rs)	3.8	6.5	0	25
8. Non-trade income (Rs)	293	671	0	3,000

The distinction between transitory and fixed in the food retailing and wholesaling business is related to the nature of ownership versus rental relations for the shop. Those who own a shop are far more likely to sell goods on credit and have a higher education than those who rent their facility. An estimated first-order correlation coefficient between shop ownership and years of education is .6. It is also interesting to note that there is a high degree of correlation (r = .48) between the size

of a shop's inventory and the number of customers who use it each week. There is what appears to be a growth or success dynamic build into the retail sector based on the number of customers available: the greater the customers, the higher the inventory and the income of the trader. If the number of customers is the key element in the retail sector (as opposed to sales volume and margins), one is led to question the effect of government ration shops on returns to this segment of the distributive sector.

The Farm Community

In the sample of 50 farmers, the average yield for wheat was 25.5 maunds per acre and for cotton 0.7 bales per acre, with wheat nearly identical to the district average and cotton slightly below (see Table 12). Crop yields were unrelated to the size of land controlled, but were, as expected, positively correlated ($r = .5$) with the marketed surplus of wheat. The amount of land controlled was highly correlated (.71) with the amount of buffalos and cattle a farmer had. Farmers who received high prices for their wheat surprisingly received low prices for their cotton ($r = -.86$).

There was no apparent relationship between the price the farmer received for his crop and the size of the land he controlled or the amount of livestock he held. Hence, one cannot automatically conclude that small farmers get low prices in the market and large farmers get high prices. Also, there was no significant correlation between land size and point of sale. Small holders were just as likely as large holders to sell their crop in the village. It may be that the small holder must sell in the village after the harvest because he lacks the resources to market his crops, while the large holder chooses to do so to avoid the inconvenience and the loss of time involved in taking his crop to market. However, judging from the prices received by the various sized land owners, it does not seem that anyone suffers by marketing in the villages.

Almost all the farmers reported difficulty in storing their crops on the farm, and several reported that insufficient storage was a major factor dictating a sale immediately after the harvest. Many farmers store in small vessels (bhrola) which can hold roughly 10 to 30 maunds of wheat, but which are impractical for long periods of storage.

For farmers, friends and the market are the source of price information. Farmers were well aware of published price information and radio price quotations, but tended to rely on local sources of information due to regional price variations.

Table 12

Farmers' Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
1. Wheat yield (md/acre)	25.5	8.3	1.5	40
2. Cotton yield (bales/acre)	0.7	.5	0.2	2.7
3. Household size	7.3	2.7	1.0	15
4. Land controlled (acres)	22	27.6	2.0	150
5. Livestock (head of cattle, oxen and buffalo)	5.3	4.6	0	20
6. Percent of wheat marketed	51	23	0	80
7. Borrow from trader (0-no, 1-yes)	.43	.50	0	1
8. Sell in village market (0-no, 1-yes)	.73	.2	0	1
9. Sale price of wheat (Rs/md)	57	2.2	53	62
10. Sale price of cotton (Rs/bu)	184	13	155	203
11. Malpractice in market (0-no, 1-yes)	.45	.50	0	1
12. Buy goods from marketer (0-no, 1-yes)	.54	.4	0	1

Forty percent of the farmers borrowed from traders and only three out of 46 farmers had sold their crop directly to PASSCO. As one farmer replied, "PASSCO gives procedure difficulties and arthis give payment difficulties." Since farmers have more experience in fighting to get paid on time than in going through the red tape of the government, they tend to deal with the government through a trader. Farmers who borrowed from traders claimed they did so because the trader was flexible in advancing loans, would help market their crop and was polite. Only four farmers in the sample borrowed from the agricultural banks alone for their production credit, and these were in the group of the large landholders (over 20 acres).

Another factor that ties farmers to particular trade patterns is the use of the food marketer as a procurement agent. Forty-three

percent of the farmers buy household goods from the marketer who sells their crop. In some cases, traders--particularly beoparis--will obtain special items such as medicines on behalf of the farmer. This sort of added service contributes a great deal toward the building of good will between the farmer and the trader. Needless to say, there is little flexibility or added service built into the government food procurement and distribution services. Consequently, many farmers were dissatisfied with the service they had received from government traders.

Although farmers do become tied to traders through cycles of debt and poverty, there was a surprising amount of trade mobility reported by the Vehari farmers. Seventy-nine percent of the farmers reported that they had switched marketers at least once in the past ten years. The reasons for the switch included: (1) better returns from other traders, (2) delay in payment from a trader, (3) credit not advanced when needed and (4) impolite behavior on the part of the trader. Overall, it appeared that farmers were satisfied with their marketers, and if problems developed they were in a position to change marketers.

The Margin

Marketing margins are rather easy to calculate but difficult to interpret. The number of different services a trader provides complicates the calculation of an equivalent margin across a sector. More important is the problem of actually determining the "real" quantity of goods traded. Farmers frequently complain and traders actually boast that the main means of deceiving the farmer is through underweighing goods. In Vehari, several marketers stated that farmers would be sure to complain if they were given a price one percent below their expectations, but that they probably would not notice or bother about a three to five percent underweighing of their crop. Accordingly, when a portion of the crop "disappears" in the transaction, it becomes difficult to impute actual prices for margin computation.

From a subsample of five beoparis who trade in several commodities, margins were calculated for several of the crops. These five beoparis were selected because their interviews were graded by the interviewer as the highest quality response. The margins are as follows:

Crop	Average Margin (Rs)	Average Percent Margin	Average Retail Price (Rs/unit)
Wheat (md)	6	9	54.75
Rice (md)	5	6	83
Maize (md)	14	20	74
Gur (md)	10	8	125
Potato (100 kg)	12	16	68
Onion (100 kg)	15	19	95

The margin listed for wheat hides the actual average trade margin. Wheat bought for immediate sale to the government carries a trade margin of two to three percent, while that which is bought and stored for two to four months carries a much higher margin of about 15 percent. For maize, the high margin is a reflection of the small market and insecure terminal markets. The margin is fairly high but reflects distant shipment points (Karachi, Lahore and Rawalpindi) and the decline in production over the past year. As expected, margins for vegetables are relatively high, reflecting the high rates of spoilage and damage and the distant terminal markets for the crops. For potatoes, the high margin on a low-value crop is primarily the consequence of a glut in the potato market. Production of potatoes in 1983 was much greater than expected, disposal is difficult and traders are demanding higher returns for "finding" terminal markets.

On the average, transport costs consume approximately half the margin of wheat and rice. Other costs borne by the beopari are octroi (entry tax, toll), commission of goods sold through an arthi and loss from damage or pilferage. For the high-volume, low-value grains the remaining margin is quite low--about one to two percent of the wholesale value--suggesting a good deal of competition in the market. For the higher value, perishable products margins are fairly high but do appear to reflect the greater risk involved in distributing these goods.

Marketers are less likely to be criticized today for speculatory price manipulation than they were in the pre-partition days. They are, however, still likely to draw complaints for the manner in which their business is conducted or, more specifically, for the component considered as malpractice.

Market Malpractice: The Legacy of the Regulated Markets

Distrust of traders seems to pervade nearly all levels of Pakistani society. The cause of much of the distrust and dislike appears to be malpractices committed by the marketers. There are a number of illegal or unethical trade practices considered malpractice. They should, however, be examined in the light of local standards and enforcement procedures.

In 1927, the Royal Commission on Agriculture was constituted to examine and report on the conditions of agriculture and the rural economy, and to make recommendations for the agrarian sector. The commission submitted the so-called Linlithgow report in 1928, and following its recommendations a marketing organization was created in the Central Ministry of India in 1935.[11]

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[11]Akhtar, *Ibid.*

The commission found that the producer was getting a small share of the consumer rupee. Only 69 percent of the wheat and rice price went to the farmer; 60 percent of the tobacco; 65 percent of the ghee; 20 percent of the apple; and 30 to 40 percent o the banana and orange. Farmers were being charged a number of fees on top of the broker's commission. They included Arhat (arthi fee), Dalali (broker fee), Tulai (weighman fee), Rolai (pan fee), Charhai (pan filler fee), Otai (bag opening fee), Munimi (scribe fee), and Falledari (weighman fee). The farmers also were asked to make donations for sweepers, guards, watermen, and beggars.[12] On top of all this, the farmers were asked to contribute to certain religious charities--a most serious indignation since the traders were generally Hindu and the farmers Muslim.

The commission also found farmers were cheated on the weight of commodities. Deductions were taken for impurities (Karda) and excess moisture (soak). A wide variety of weights and measures were used. A seer, for example, equaled 32, 80, 85 or 102 tolas depending on the market. Overall, the use of inaccurate scales and false weighing were estimated to contribute another five percent to the commission of the trader.[13]

The enactment of the Punjab Agricultural Produce Markets Act in 1939 was the prime result of the Royal Commission Report. The act prescribed the establishment of Market Committees, the local bodies empowered to regulate the sale and purchase of agricultural commodities and to provide amenities in the mandies to facilitate trade. The act also fixed commission rates, market fees on the sale of commodities and licensing procedures, and placed limits on the nature of goods traded in the agricultural markets.[14] The act has been revised and superseded a number of times and, at present, the Punjab Agricultural Produce Markets Ordinance of 1978 is the major regulation for the operation of the agricultural markets.

While the Agricultural Produce Marketing Act was passed to provide an orderly structure for the conduct of market business, a number of other laws were passed to regulate the form in which market affairs could be handled. The Punjab Weights and Measures Enforcement Act of 1975 and the Punjab Weights and Measures Enforcement Rules of 1976 legislate a system of defined primary and secondary weight standards, establish the powers and duties of inspectors and set penalties for noncompliance with weighing

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[12]Malik Irshad Ahmed Arshed, "Comments on the Agricultural Produce Markets Act V of 1938," in Manual of Agricultural Produce Market Laws, Lahore, 1982.

[13]*Ibid.*

[14]Government of Pakistan, "Agricultural Produce Markets Act of 1939," in Manual of Agricultural Product Laws, Lahore, 1982.

procedures. A series of pure food laws were passed, beginning with the Pure Food Ordinance of 1960, to govern the quality of the foodstuffs sold in the market. These laws were primarily for ridding the market of food adulteration, misbranding and sale without a license.[13]

In addition, a series of acts and regulations have been passed to provide for powers to limit the movement of grains between districts, to control the prices of essential foodstuffs on a local level (in addition to national regulations) and to prohibit speculative trade in foodstuffs. The West Pakistan Foodstuffs Control Ordinance provides a set of maximum stock regulations, movement controls and option/speculation restrictions. The Foodstuffs Control Acts came about as a result of shortages resulting from World War II. An Essential Supplies Act was passed to prohibit hoarding, and wheat rationing was introduced in the larger cities.

The influx of nearly three million refugees after Partition put added strain on the food distribution system, and large quantities of U.S. PL 480 wheat were imported and distributed through government depots. To ensure the availability of basic staples at reasonable prices, the government passed the West Pakistan Foodstuffs Control Act of 1958, which gave the government broad powers over the distribution of wheat. This, plus controls on milling under the West Pakistan Flour Mill Control Order of 1959, allowed the state broad powers to regulate the quantity of wheat milled and distributed throughout the nation.[14]

The controls on food distribution and consumption intensified as shortages and the war in the early 1970's required the strict rationing of essential goods. In 1972, the Punjab Paddy and Rice Control Order was passed to restrict the movement and storage of rice by non-government agents. That, plus the earlier control orders for sugarcane, tea, gur and kerosene provided the

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[13]See, for example, the Pure Food Ordinance of 1960, the Pure Food Rules of 1965 and the Cantonments Pure Food Act of 1965, in Anwar Ali Chaudry, Food Laws Manual, 1977 edition, Lahore Law Times Publications, Lahore, 1977. For regulations on weights and measures see the Punjab Weights and Measures Enforcement Act of 1975 and the Punjab Measures enforcement Rules of 1976, in the Manual of Agricultural Produce Market Laws, Lahore, 1982.

[14]The earliest of the control rules is the Sugar/Products Control Order of 1948. The base for many of the modern control laws is the West Pakistan Foodstuffs Act of 1958. These and other food control acts can be found in the collection of Anwar Ali Chaudry, *op. cit.*

regulatory infrastructure needed for the rationing of these items in times of hardship.[17]

In 1972 the regulatory zeal over food distribution reached its zenith with the passage of the Punjab Economy of Food Order. This order regulated the charitable and ceremonial distribution of foodstuffs--even providing sample menus for banquets and state functions.[18] Although never enforced, this regulation does indicate the seriousness with which the government went about regulating the food distribution business--within households, at the market, at the mills and in storage centers.

During the wave of nationalization of the mid-1970's, cotton ginning, sugar mills, ghee plants and flour mills all came under direct state control. A series of laws and regulations were passed, establishing state corporations to take over the functions of these mills, and local governmental bodies were set up to regulate their activities. Under the present government, there was been a rapid denationalization of wheat mills and sugar factories, and a slower movement out of the ghee industry. Distribution of ghee, wheat, rice, sugar and cotton is still partly in the state's hands, although quasi-independent, parastatal operations have been provided a mandate to efficiently conduct marketing operations.

To a great degree, what had begun as a means of cleaning up the marketplace through regulation under the British, has become a system of reform through confiscation of authority by the state under the various Pakistani regimes. At times, the adoption of authority by the state over the food distribution system has been done out of reformist interests, while at other times, interests of national security, national aspirations and political survival have dictated such actions. The net result has been pretty much the same. What began as a malpractice by the private sector has led to reform through takeover by the state.

The Extent of Malpractice

What can be called a malpractice goes against the written rules of the Marketing Act, the Pure Food Ordinances and the various Control Laws, and violates the unwritten code of the marketer's conduct. The most exhaustive critique of contemporary marketing malpractice is the study of agricultural marketing in the Sargodha Division by Chaudry, Khan and Rauf of Faisalabad

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[17]See the West Pakistan Rice Ordinance of 1959, the Rice (Movement Restriction) Order of 1958, the Punjab Paddy and Rice Order of 1972 and the Rice Milling Control and Development Ordinance of 1976, in Food Laws Manual, *op. cit.*

[18]The law in question is the Punjab Economy of Food Order, 1972, *Ibid.*

University.[19] These authors document scores of instances of market malpractice and conclude that there has been little enforcement of the Agricultural Marketing Act. From the survey in Vehari, a number of cases of market malpractice were recorded. Some of the more common are as follows:

Malpractice	Private Trader	State Trader	Farmer
Underweighing	x	x	
Adulterating products	x	x	
Adding Weight (soak)	x	x	x
Embezzling transport fees, storage charges	x	x	
Under/overgrading	x	x	
Demanding bribes		x	
Pricing below support levels		x	
Embezzling mosque donations	x		
Overcharging on commissions	x		
Late payment		x	
Charging functionary fees (chungi), etc.	x		

These are only a small fraction of the types of malpractice that appear to be common in the Punjabi agricultural markets today. Not included would be those forms of malpractice committed by market committee members in the collection of the market fee by the municipal authorities for the repair of market facilities; by the state banks for the advancement of loans to traders, and so on.

There are two important qualitative changes in the types of malpractice of the present era compared with those of the pre-partition Hindu-controlled marketing era. The first is that land is rarely used as collateral for an agricultural loan. Traders handle bad debts by rolling them over, applying family pressure on the farmer, blacklisting the farmer in the market and, although rarely done, appealing to local community leaders to assist in the collection of a bad debt. Relative to pre-partition days, it would be rare for a trader to confiscate land as repayment for a bad debt and, in most instances, it would not be feasible due to the lack of political support in the community for such an action.

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[19] A. M. Chaudry, A. S. Khan and A. Rauf, An Evaluation of Agricultural Marketing (with special references to Sarghoda Division), West Pakistan Agricultural University, Lyallpur, April, 1970.

The second change really appears to be in the nature of the state in the market malpractice arena. As state activity in the distribution of wheat, cotton, rice, sugar, oilseeds, fertilizer, pesticide and seed has increased greatly during this past decade, the scope for illicit activities with official sanction has increased as well. The institution of payments to state officials to facilitate the movement of foodstuffs means marketing costs have a transfer payment element included that will serve to block careful regulation of the markets and the inspection required to formulate measures to improve the efficiency of these centers. This has also led to a qualitative change in what might be called the "appetite" for malpractice in the market. As Carl Gotsch states,

> The private miller, fertilizer dealer, arthis or other businessman knows that dishonesty may cost him customers and future income. Government institutions, by contrast, tend to provide few incentives to increase the volume of business of their establishments and therefore, the satisfaction of their customers.[20]

It is interesting to note how widespread the recognition of market malpractice is. In the Vehari survey, all the traders and farmers were asked to comment on the extent of market malpractice in the district. When asked if they were aware of any malpractice in the marketplace such as underweighing, fixed price auctions and payment of extra commissions and fees, the following responses were recorded:

Group	Percent Aware of Malpractice	Percent Not Aware
Beopari	28.7	71.3
Arthi	31.4	68.6
Dukandar/Karyana	34.3	65.7
Farmer	30.4	69.6

It is not surprising to note that the majority of the people do not admit the existence of malpractice to a survey team. After all, these are crimes and the appropriate forum for reporting a crime may not be to an outside survey group. Interesting to note, however, is that a higher percentage of traders than of farmers admitted to knowledge of malpractice and were willing to provide that information to an outside survey team. This does indicate traders are aware and reasonably cavalier about the extent of malpractice in their business.

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[20]Gotsch and Brown, *Ibid*, p. 53.

The Effects of Malpractice

The consequences of market malpractice are many and varied, depending a great deal on the degree to which the particular malpractice is considered a part of economic tradition as opposed to being a relatively new phenomenon. There are organizational, political, social and economic dimensions to malpractice just as there are to the practice of marketing itself. Marketing bridges the gap between agricultural producers and consumers, while marketing malpractice defines the gap between that which is legal and that which is tolerated. Four general consequences of market malpractice are of great significance to the marketing system as a whole.

Institutionally, market malpractice contributes to an economic atmosphere in which there is intentional disunity in the operation and reinforcement of the biradiri system as a means of conflict resolution. By intentional disunity, it is suggested that there is a high degree of atomization in the market and that a high premium is attached to keeping the business within one's own family. The need for individuality in trade follows from the importance attached to personal good will and business skill. Also, when nearly everyone is guilty of some malpractice, it becomes difficult to conduct business openly and publicly. A great deal of importance is attached to keeping multiple sets of books; of working with small staffs, or insulating the activities of the field offices from the central office; of paying to protect one's anonymity, and so forth.

Nearly everyone does business within the family. One reason for this is that no one wishes to share the secrets of his trade--especially the malpractice component--with too many people outside the family. This also reinforces the use of the biradiri as a decision-making and problem-solving group for each trader.

The biradiri is a kin group composed of consanguineal and affinial relatives. It is an endogamous unit, limited by the extent and distance to which one can recognize kinship, and is reinforced by an intricate system of gift exchange. According to Wakil, the biradiri

> . . . defines for the individual rights, duties, sentiments and rules of general conduct. . . . it reinforces the solidarity of the kin group [and] on the latent level, it performs the functions of credit and loan institutions. . . . one's kin group is one's major defence against personal wrongs and injustices.[21]

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[21]Parvez A. Wakil, "Explorations into the Kin Networks of the Punjab Society: A Preliminary Statement," Journal of Marriage and the Family, 1970, p. 704.

In the market, collection of overdue loans, settlement of disputes between traders and between traders and government officials, and perhaps most important, the initiation of new traders into the business is done within the family. The biradiri defines the limit on where malpractice is discussed and contained.[22]

Another effect of malpractice is that by adding layers of complication to the business the economic efficiency of marketing is reduced. Costs of bribery, protection, multiple sets of books and extraneous license fees are all added to the cost of moving foodstuffs. The marketing system suffers from a multiplicity of traders and functionaries who each take a small share of the total margin when, in fact, a much smaller number is required to move the goods. In part, the large number of traders and other intermediaries are required to maintain the multiple sets of books and shield the arthi from government inspection.

Another area in which market malpractice contributes to direct economic inefficiency is in the delay introduced from what can be termed "new malpractice." Classically, food brought to a government depot or mill can be rejected on quality grounds or can be held up for delay due to the load in the office. The cost to the farmer of the delay is great enough to justify a payment for expediting the service or, in the case of a quality disagreement, for accepting the lot. These practices are generally well known and there is an ample cadre of beoparis who can facilitate such transactions. In comparison, the initial delays in issuing fertilizer licenses for agency rights in the early 1970's and pesticide licenses in 1981/82, have led to shortages, black marketing and lower agricultural production. These costs result from what can be considered as "newer, first-time malpractice" as opposed to the more continuous, traditional type.

In some cases, market malpractice reduces the cost and consequently increases the efficiency of marketing services. Because of the high rates of taxation on personal income, marketers nearly universally understate their market volume and income.

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[22]The cohesiveness of the family unit can be counterposed with the atomization, or disunity, of the market with an example of storage patterns during a rainfall. Frequently, several traders will have their platforms filled with goods while others will have empty storage space. As it begins to rain, traders direct their weighmen to cover their wares with drop cloths and tarps. If it rains hard, a good portion of their goods will get soaked, resulting in the loss or damage of what can be a significant part of the trader's produce. Rarely does a trader request the use of his neighbor's empty storage space. Leaving goods under a neighbor's cover is considered too risky in the sense of providing an opportunity for theft, hard feelings between neighbors and for repayment of favors.

The costs of unpaid taxes are, to an extent, passed back to farmers and up to consumers in terms of a lower trade margin.

Another consequence of market malpractice related closely to the loss in efficiency is the inability to maintain product quality standards. At the farm level, adding some sand and dirt to a bag of grain will increase the weight of the product at auction. For the trader, mixing dirt with the product, or mixing lower with higher higher grades of a product, can also yield a higher value final product. At the mills, for example, it has been reported that at one time the mixing of IRRI rice with Basmati was on the order of 50 percent, causing difficulties in the development of the export trade.[29] The lower quality of the final product also leads to higher marketing costs, as that which is adulterated is then, in some cases, cleaned, and limits the scope of the market to low-quality produce. As discussed earlier, there are a great number of Pure Food Laws and Ordinances, yet these are some of the most difficult of the marketing laws to enforce and they are rarely invoked unless serious cases of food adulteration arise.

A final consequence of market malpractice is the difficulty it leads to in the local political arena. Market malpractice, because of its technical illegality, is difficult to administer. At the local level the administrative responsibilities of the deputy commissioner's office to keep the district running trouble-free can clash with that of the line agencies, particularly Agriculture, in governing the market. For example, when production in a district is below expectations and prices begin to rise, the deputy commissioner's office, empowered by the Agricultural Control Ordinances, can set *ad hoc* control prices and place movement controls on essential foodstuffs. The use of control measures pits the commissioner's office against the interests of the local traders who profit most from the free spatial arbitrage of foodstuffs. The enforcement of these emergency acts rests with the Agriculture Department, PASSCO, the Food Department and others, depending on the commodity. The difficulty in enforcing such measures, coupled with the profitability of malpractice, pits the emergency wishes of the deputy commissioner's office against the routines of the line agency.

Conclusions

The expansion in agricultural output of the past decade places new strains on Pakistan's food marketing system. Marketing facilities in the Punjab, over the past decade, have managed to accommodate the increases in agricultural output through an expansion of feeder markets, new road and transport facilities and, more importantly, the expansion of unregulated markets and government procurement systems.

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[29]Gotsch and Brown, *Ibid.*

In a study of agricultural marketing in the district of Vehari, traders were found to be in the middle-income segment of society, with a hierarchy of earnings within the trade sector between arthis, beoparis and karyana merchants that reflects the permanency of these occupations. Trade is still based largely on a system of mutual debt-induced dependency between traders and farmers and among the traders themselves. However, the flexibility of the traders, particularly in servicing government procurement centers and in adopting agency rights, contributes a great deal to the continued buoyancy of the "traditional" mandi.

Although there has been a rapid expansion of institutional credit expended in recent years, nearly half of all farmers interviewed obtained production loans from traders. In addition, debt capacity provided to be the most important explanatory variable for arthi income.

In the food retailing sector, income proved to be elastic with respect to the number of customers. Since urban retailing is characterized by a high volume of low-expenditure sales, competition for customers is fierce. This accounts, in part, for the animosity between the fixed-location shopkeepers and the mobile food peddlers.

The trade sector continues to draw criticism, although certainly more muted than before Partition, due to malpractices committed in the market. Underweighing, charging excessive commissions and adulterating products are common practices in both private and government food markets. Market malpractice is supported by the atomistic/biradiri-based structure of the mandi and contributes to inefficiencies in marketing, low quality standards and difficulties in administering the affairs of the market and the local community.

The coming decade promises to be filled with a host of important changes in food marketing. As the volume of commodities traded continues to rise, some mix of regulated, unregulated and state markets will emerge to handle their distribution. Encouraging one mix or another is the choice of both the government and the private sector in the years to come. Increasingly, a choice will have to be made between an expensive, controlled state trading system and unregulated or "wild" markets. This choice is complicated, however, by the pervasiveness of malpractice in the market and by the gulf between popular perceptions and the realities of the trade.

BIBLIOGRAPHY

Akhtar, Mohd. "Observations on Marketing of Foodcrops in the Punjab" (mimeo). 1983.

Ali, Muhammad Manzoor, M. A. Cheema and Ateeque Ahmad. Marketing of Farm Products and Farm Inputs in 'Barani' Punjab and NWFP. Publication No. 176. November 1979.

Arshed, Malik Irshad Ahmed, ed. Manual of Agricultural Produce Market Laws. Lahore, 1982.

Ashiq, Mohammad. Area Allocation Decisions: A Study of Pakistani Farmers' Responsiveness to Changes in Prices. Occasional Study, Punjab Economic Research Institute, No. 186. May 1981.

Aslam, Mian M. "Some Comparative Aspects of Production and Profit Functions: Empirical Applications to a Punjab District." Pakistan Development Review, Vol. XIII, No. 2 (Summer 1978).

Bell, Peter R. and Janet Tai. "Markets, Middlemen and Technology." Malayan Economic Review, Vol. 14 (April 1969).

Bohanna, Paul and George Dalton, eds. Markets in Africa. Northwestern University Press, 1962.

Chaudry, A. M., A. S. Khan and A. Rauf. An Evaluation of Agricultural Marketing (with Special Reference to Sarghoda Division). West Pakistan Agricultural University, Lyallpur. April 1970.

Chaudry, Anwar Ali. Food Laws Manual, 1977 edition. Lahore Law Times Publications. Lahore, 1977.

Chaudry, M. Ghaffar. "Green Revolution and Redistribution of Rural Incomes: Pakistan's Experience." Pakistan Development Review, Vol. XXI, No. 3 (Autumn 1982).

_____. "Pakistan's Agricultural Policy: Lessons from Recent Wheat Policy" (mimeo); and "The Operation of the Wheat Market in Pakistan" (mimeo). Pakistan Institute of Development Economics. Islamabad, 1983.

Chughtai, S. A. "Marketing in Agricultural Products" (mimeo). USAID. 1968.

Cummings, John Thomas. "Cultivator Market Responsiveness in Pakistan--Cereal and Cash Crops." Pakistan Development Review, Vol. XIV, No. 3 (Autumn 1975).

Falcon, W. P. "Farmer Response to Price in a Subsistence Economy: The Case of West Pakistan." American Economic Review. May 1964.

Gotsch, Carl and Gilbert Brown. Prices, Taxes and Subsidies in Pakistan Agriculture. World Bank Staff Working Paper No. 387. April 1980.

Government of Pakistan, Finance Division, Economic Advisor's Wing. Pakistan Economic Survey, 1980/81. 1982.

Government of the Punjab. Punjab Development Statistics, 1981. Lahore, 1982.

Hedlund, Floyd F. and Marion F. Ward. "Survey of Agricultural Marketing in West Pakistan" (mimeo). USAID. May 15, 1968.

Hussain, S. M. "A Note on Farmer Response to Price in East Pakistan." Pakistan Development Review, No. 4 (Spring 1964), pp. 93-106.

Johnson, E. A. J. The Organization of Space in Developing Countries. Cambridge, Mass: Harvard University Press. 1970.

Jones, William O. Marketing Staple Food Crops in Tropical Africa. Ithaca, N.Y.: Cornell University Press. 1972.

Khan, Dilawar Ali and Qamar Jabeen. Agricultural Price Behavior in Punjab's Markets: An Exploratory Analysis. Punjab Economic Research Institute. Lahore, July 1978.

Khan, Riaz Ahmad. "Issues of Food Distribution in Pakistan" (mimeo). Pakistan Agricultural Research Council. 1982.

Krishna, R. "Farm Supply Response in India-Pakistan: A Case Study of the Punjab Region." The Economic Journal, Vol. LXXIII, No. 291 (September 1963), pp. 477-487.

Lele, Uma J. "The Traders of Sholapur," in Developing Rural India, eds. John Mellor, et al. Cornell University Press. 1968.

Mears, Leon. The New Rice in Indonesia. Gadjah Mada University Press. Indonesia, 1982.

Qureshi, Sarfraz Khan. "Price Responsiveness of Marketed Surplus of Wheat in Pakistan." Pakistan Development Review, Vol. XIII, No. 2 (Summer 1974).

_____. "The Performance of Village Markets for Agricultural Produce: A Case Study of Pakistan." Pakistan Development Review, Vol. XIII, No. 3 (Autumn 1974).

Rashid, Abdur. The State of Agricultural Marketing in Pakistan. Lyallpur: West Pakistan Agricultural University Press. 1969.

_____. Economic Aspects of Distributive Margins. Lyallpur: West Pakistan Agricultural University Press. 1970.

_____. The Marketing of Wheat in West Pakistan. Lyallpur: West Pakistan Agricultural University Press. 1971.

Siddiqui, S. A., et al. Marketing of Agricultural Products in the Sind. Tandojam: Sind Agricultural University, Department of Agricultural Economics and Rural Sociology. 1979.

Stevens, Robert D., et al. Rural Development in Bangladesh and Pakistan. Honolulu: The University Press of Hawaii. 1976.

Tabor, S. and Dale Squires. "Marketing Margins of Secondary Crops in Indonesia." Ekonomi dan Keuangan Indonesia. September 1982.

USAID. Edible Oils Study: Project Papers. Islambad, 1983.

Wakil, Parvez A. "Explorations into the Kin Networks of the Punjab Society: A Preliminary Statement." Journal of Marriage and the Family. 1970.

Yasin, Ghulam, et al. Marketing of Agricultural Products in the Punjab. Lahore: Punjab Board of Economic Inquiry. 1976.

POLICY, ORGANIZATION AND MANAGEMENT OF THE EXTENSION SERVICE OF PAKISTAN

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SUMMARY AND RECOMMENDATIONS

Policy Issues

Negative policies are:

1. the locked-in, low salary scales of field assistants (FAs);

2. the policy which denies FAs access to university-level education;

3. the concentration of most agricultural universities upon formal, "high level" academic training to the exclusion of practical and applied research and outreach;

4. the lack of effective linkages in general, between agricultural research and extension and in particular, between those functions and the agricultural universities;

5. lack of a sufficiently high price floor to sustain farmer response in nontraditional oilseeds production;

6. lack of adequate and available collection points and facilities for small farmer marketing of oilseeds; and

7. lack of accurate statistics on farm management for the agricultural industry.

Positive factors include (1) a discrete and defined educational role for extension; (2) recognition within departments of agriculture that research and extension functions are important; (3) a willingness to adopt new organization arrangements to take advantage of donor support; and (4) current interest of the Agricultural University of NWFP in linking research and extension.

Major organizational changes in administrative structure are not recommended as desirable or feasible. For the most part, existing structures should be utilized and project support should seek to add appropriate technical assistance for effective research and extension.

Staffing

This report recommends selected areas where oilseed-specific or other agricultural extension program requirements could be met. Those needs would provide a more adequate research/extension support base for an intensified program of oilseed production.

Recommendations

All recommendations are discussed in detail in the body of this report. It is important that all efforts be coordinated with other projects--proposed or existing.

Recommendations having immediate budgetary implications for an oilseed project are:

1. Support oilseed senior subject-matter specialists (SSMS) in agronomy from the Provincial Agricultural Research staffs. These would be specialists in oilseed crops. One specialist would be assigned to each of the Adaptive Research Farms (ARFs) in each province. In addition to regular Pakistani research and extension staff, one of these specialists in each province should be a Ph.D.-level expatriate who would serve as advisor and coordinator of the oilseeds work in other ARFs of the province.

   Staffing required:

	Total	Expatriate	Pakistani
Punjab	2	1	1
Sind	2	1	1

2. Support one Agricultural Officer (AO), M.Sc.-level, posted to each Agricultural Research Institute (ARI) to provide extension priority needs to researchers and to provide to extension relevant research from ARI efforts.

   Staffing required:

	Total	Expatriate	Pakistani
Tando Jam	2	1	1
Faisalabad	2	1	1
Tarnab	2	1	1
D. I. Khan	1	-	1

The expatriate in the Northwest Frontier Province (NWFP) should provide training for counterparts at both stations. The ARI at D. I. Khan is included since it is the major institute for rain-fed agricultural research in NWFP.

An additional AO might be posted at the ARI in Sariab, Quetta, Baluchistan. The Government of Pakistan (GOP) should explore this option once the project staff is fielded in the other provinces. Consideration should be given to relate it to the newly-proposed project at the Agricultural University, NWFP, which might carry this responsibility.

Funds should be provided for Pakistani research and extension personnel to spend at least three months each in a

foreign country at a research-extension/research-demonstration center. Such an experience would enhance their understanding of jointly applied research and extension functions.

3. Add one staff member to each of the ARIs who is a specialist in oilseeds. Provide a sufficient operating and travel budget for outreach training by the specialist to field assistants (FAs) and AOs on the job in their districts.

Staffing required:

	Total	Expatriate	Pakistani
Punjab	2	-	2
NWFP	1	-	1
Sind	1	1	1

4. Support an expanded agricultural information service. An oilseeds project should support one expatriate extension information specialist assigned to the Agricultural Information Services in the Punjab, NWFP and Sind. Arrivals should be phased over two years in accordance with the degree of affirmative reaction in each province. In addition, two Pakistani information specialists--one audio visual and one publications and news articles)--should be supported as trainee counterparts in each of the three regions.

This support should be conditional upon the willingness of each provincial Secretary of Agriculture to combine within a two-year period, agricultural information functions into a single information office attached to the office of the Secretary. Although initially an oilseeds effort, this effort should be viewed as leading to expanded activities to consolidate, intensify and stimulate a comprehensive agricultural information service.

Staffing required:

	Total	Expatriate	Pakistani
Punjab	4	1	3
NWFP	4	1	3
Sind	4	1	3

5. A project should include TDY support for two expatriate specialists--one in extension administration and one in applied research administration. They would provide periodic review, counsel and guidance.

Staffing required:

Six person months annually, plus supporting per diem and travel costs. The individuals selected would be responsible

for monitoring all three areas outlined in recommendations 1-3 above.

INTRODUCTION

A basic premise undergirds this report. In spite of their weaknesses--and there are many--the extension and research functions in Pakistan must not be abandoned. The agricultural sector of the nation cannot move forward without continued and effective research and the means to disseminate new knowledge to agricultural producers and encourage its use. Schemes which seek to establish separate research and extension systems should be avoided. Multiple extension services for various crops would result in bureaucratic competition and confusion at the farm level at a very high financial cost to the government.

The focus of research for the foreseeable future should be on applied research, using international sources from which to adopt technologies to the Pakistan environment. The focus in extension must be on upgrading staff, developing effective management and in-service training, and above all, having access to and using applicable new technology. Extension can be only as good as the information it disseminates. Yearly repetitions of "the same old message" by FAs and AOs will not serve farmers, the extension services or the country.

Characteristics of the Pakistan Extension Service

The first obvious characteristic of extension is that it is basically provincially financed, administered and oriented. This provides for flexibility to respond to provincial needs that might be lost if federal domination existed.

The basic administrative organization of the Extension Services is quite similar from province to province. In all cases, extension is part of the Department of Agriculture. Currently, there are two Directors of Agricultural Extension in Sind (Upper and Lower) who report to the Director General of Agriculture. In the other provinces, extension is headed by a Director General of Agricultural Extension. The Director General of Agricultural Extension is a peer of other Directors General whose titles may vary in different provinces, but include agricultural research as one of their functions. The arrangements, which are slightly different for each province, are illustrated on the organization charts in Appendices 1-5.

Two federal influences upon extension are noted--one positive and one negative. The positive influence is the identification of national production goals which can then be made a part of provincial production targets. Production targets given to extension are reflected in the program priorities at each

district level.

The negative influence is felt in the pricing and salary policies of the federal government. Price incentives today for sugarcane make it a desired crop in spite of an increasing surplus of sugar, while low base prices for nontraditional oilseeds make them desirable only as an addition to such basic crops as rice, cotton or wheat. The federal policies in grades and salaries paid to extension personnel must be viewed as unfair disincentives, particularly at the FA level.

Extension appears to have widespread name recognition throughout the country. Its reputation is mixed. Some accept it readily, while others view it as inept, inactive and inefficient. There is a sense of dedication by some at the field level, but there is also frustration. This focuses on lack of offices or housing, lack of transportation or communication and the fact that appropriations for operating expenses are never met in full. The IBRD-sponsored training and visitation (T&V) program should correct some of these deficiencies in project districts. Evaluations of that project should be monitored since the results may indicate highly relevant priorities in budgets, staffing, housing, training and travel.

The organizational structure of the Extension Services is reasonable. The World Bank seeks an FA-to-farmer ratio of 660 to 680 per farmer rather than the normal 1,000. But greater concern could be expressed for operating and travel support; more adequate in-service training, closer linkages to research and agricultural universities, and particularly for grade, salary and promotional improvements. It is felt that these are more important issues than additional staff members. Adding more people without removing current impediments and disincentives will make little difference in support to farmers themselves.

The government should be commended for its decision to delete from extension any responsibility for delivering agricultural inputs to farmers. Extension is appropriately given an educational job. Its assignment is correct. But ability to perform that assignment is weakened by the factors mentioned above.

A major federal policy affecting extension is the grade and salary classification which places FAs at Grade 5 and AOs at Grade 17 with salary levels at specified rates. AO starting salaries are Rs 1,500 per month and FAs begin at Rs 290 with increases of 10 rupees per month per year to a maximum of 540 rupees plus allowance of 40 percent of salary. Beldars--field workers--are paid Rs 250 to a maximum of Rs 290 per month.

Tenth-year matriculants, for example, can work for the government as administrative assistants at Grade 5. The FA with two additional years of training is held at that same grade, except in Punjab where a Grade 9 inspector position was recently created for FAs with considerable seniority. Past provincial programs which allowed some FAs to be promoted to AO positions have now

been abolished. It is probably desirable for salaries to be uniform across the country, but they must be raised to a living wage if there is to be an increase in morale and effectiveness.

SITUATION AND RATIONALE

No attempt is made herein to restate observations and data contained in the numerous studies on marketing, processing and production in the Pakistani edible oilseed industry. This paper will assume that recommendations for donor assistance to this subsector of Pakistan's agriculture are affirmative. Frequent references will be made in what follows to agricultural research which is basic to any successful extension program. A detailed analysis of research has been published by the Economic Development Center, University of Minnesota, dated October 1982, and is accepted as an applicable reference document pertaining to research. The agronomics sub-team has examined the structure and function of agricultural research in Pakistan specifically with regard to the oilseed subsector.

Appropriate new technology must be developed, transferred to and used by farmers on a sustained basis if Pakistan's agricultural production is to be improved. This is our view and that of others who have studied Pakistani agriculture. In spite of its weaknesses, the Extension Service is that portion of the public sector assigned primary responsibility for technology transfer in Pakistan. This report concentrates on the Extension Service as a critical support activity for an effective program to increase oilseed production, particularly in nontraditional crops such as soybeans, sunflower and safflower.

Concentration in this paper is on the structure, staffing, funding and function of the Extension Service with heavy emphasis on function. Additional attention is given to the linkages among extension, cooperatives and the Ghee Corporation of Pakistan (GCP), as well as to those which exist between the provincial extension services and the union and district councils.

The Extension Service, Department of Cooperatives and GCP are significantly different in their respective internal organizations and functions in each of the four provinces. They also differ substantially in their inter-relationships from province to province, and even from area to area within a given province. Therefore, this report makes observations and recommendations concerning organization and linkage that are largely based upon the existing situation and future action possibilities at the provincial level. This appears appropriate despite the fact that an oilseeds project would, with foreign donor assistance, have to be routed through the federal Ministry of Agriculture, Food & Cooperatives. Implementation of the recommendations that follow would, in most instances, be possible at the provincial government level. In some instances, however, especially where grade, salary and job qualifications are at issue, federal level

approval would be required.

During three and one-half weeks of field work, all three agricultural universities in the country were visited to examine their relationships to extension and their capacity for both research and extension support. Agricultural Research Institutes were visited at Tarnab and Mingora, NWFP; Tando Jam, Sind; and Faisalabad, Punjab. Extension offices were also visited and personal interviews conducted with individuals ranging from directors general to field assistants. Both small and large farms were visited. Some farmers interviewed were selected by extension agricultural officers, or GCP representatives, but many were randomly selected as the team drove through rural areas. During farm visits, both men and women were interviewed.

A depressing and recurrent theme in conversations, observations and other reports was the consistent acknowledgment that the Pakistan extension service is isolated from research and universities, under-financed, under-trained and held in low esteem by at least a significant portion of the professional agricultural community as well as some segments of the farming community. But many who criticized extension felt that it still was the most credible and logical agency to provide new technology to farmers.

An agricultural policy analysis conducted in December 1982 by Dr. K. C. Nobe correctly points out that, ". . . it should be clear that the small and medium sized farms are the only sources from which significant additional production responses can be extracted in the short run." The field interviews lead to a conclusion that large landholders are either ahead of the Agricultural Extension Service or are very traditional, wealthy and unlikely to make significant alterations regardless of government efforts.

On this basis, concentration was primarly upon the extension service as the only logical agency to help small and medium farmers understand and apply new technology consistent with the production emphasis of the federal government. It is also the only agency that has a chance of reaching sharecroppers and tenants, other than indirectly, through the feudal landlord class.

A basic premise of this report is that (with one exception--Information Services) the existing administrative structures in the agriculture sector will not be significantly altered by programs dealing with only oilseeds. A second premise is that any donor support to the edible oilseed industry should collaborate and support other related donor-funded projects such as the "Extension and Agricultural Development Projects" funded by the World Bank in Punjab and Sind, whether or not these projects deal directly with oilseeds. Some recommendations are specific to an oilseeds project; many, of necessity, deal with extension as an educational organization.

This report has taken the view that forcible reassignment of research and extension, which might be ultimately desirable, would be dysfunctional at this time. The agricultural universities, with the exception of the Agricultural University NWFP at Peshawar, are simply not interested or committed enough to practical problems of applied research and extension to provide effective leadership. Efforts which might bring the universities, research and extension together should be supported. It is unlikely, however, that the 1962 breakup of research and extension from the agricultural colleges can be recitified on a national level in the immediate future and certainly not by an oilseeds project. There might be advantages to placing the Agricultural Training Institutes (ATIs) in the area of responsibility of the agriculture universities, but only if each director general of extension could provide some control over course content and practical field work.

1. Linkage to Agricultural Research

The February 24, 1983, announcement of government recommendations of a new disease-resistant wheat variety (PAK-81) and approval by the Punjab Seed Council of new varieties of grains, oats, sugarcane and mung beans shows progress in crop production research. Once the government has accepted new research and given it appropriate emphasis, it is fairly easy for extension to give support. A major problem persists, however, in weak linkages from research to extension and apparent heavy reliance upon the Information Services to provide information to extension.

The Agricultural Extension Services in the IBRD-funded project districts are being supported in developing ARFs. Given the poor linkages between the ARIs and extension, and the need for adaptive research for small farmers, the operation of ARFs by extension is a hopeful and logical development. An oilseeds project should take advantage of the ARFs for testing and further adaptation of oilseed varieties and testing of cultural practices. The T&V posting of senior subject matter specialists (SSMSs) at the ARFs, two of whom are from agricultural research, is an initial step toward closing a serious gap between research and extension, but falls far short of effective linkage.

The best short-term impact may be achieved by assigning much of the adaptive research to extension with more complex research assigned to the ARIs. The ARIs would then maintain linkage with international research institutes and Collaborate Research Support Program (CRSP) projects and initiate applied research. Adaptive research, farming systems research and on-farm trials would become primarily an extension responsibility drawing upon ARIs for significant research requiring local testing and/or adaptation. These should be given maximum use of extension personnel assigned to ARIs and research personnel assigned to ARFs. This concept would require monitoring to ensure that research did not become so basic as to isolate itself from practical problems.

A provincial conference of research, extension and information service personnel should be scheduled at least annually for joint planning and information exchange. This might substitute well for the currently moribund provincial research coordination committees.

2. Linkage to Agricultural Universities

It is truly dismaying to observe the void today between extension and the universities. That this situation should exist when the two were once part of a unified system is all the more disappointing. Alumni of agricultural universities interviewed reported absolutely no contact with their alma mater of either a personal or university extension nature. The only effort mentioned was a yearly meeting of "the old boys" reported by one vice chancellor. No one interviewed, however, participated in this largely social, rather than programmatic, relationship.

Universities obviously cite budget shortages as the reason for doing so little field-type research. Except at Peshawar, little or no real commitment by the universities toward serving extension's needs other than as a provider of B.Sc. or M.Sc. graduates for AO positions within extension was found. (In NWFP at least, the extension service foots the bill.) The proposed project at the Agricultural University of Peshawar should be viewed as a pilot effort to re-establish linkages. At Faisalabad, the action-research carried on by Cooperative Department faculty with small farmers and tenants to create cooperatives was, apparently, ridiculed until FAO support was received.

If departments of extension education could become more involved in meeting on-going training needs of extension, both the universities and extension would benefit. Periodic training of AOs and FAs conducted at the district level could provide a needed stimulus to the academic departments, a more relevant experience base for the instructional programs and expose extension personnel to new concepts in program planning, management and evaluation. Support for developments of this nature are not, however, appropriate responsibilities for an oilseeds project alone.

3. Linkage to Cooperatives

Linkages here are virtually nonexistent, and this is admitted both by Extension Service and Cooperatives Department staffs at senior and junior levels. Some linkages have occurred at the district or sub-district levels in Punjab where individual staff members from each department have formed personal working relationships, or where such relations have been encourged under special projects such as the Seed Exchange Program which was operated in Faisalabad in 1980-82.

Cooperatives Department staff, sub-inspectors, inspectors, assistant and circle registrars and registrars are charged with forming, auditing and monitoring various types of cooperative societies. In most provinces, the main purpose for which the department forms societies is to provide short and medium-term credit, either in cash or in kind, i.e., fertilizer, seed, pesticides, machinery, etc. Credit-worthiness and societies' allocations are determined by the Cooperatives Department staff, including those posted in the provincial cooperative banks and their district-level offices. Individual loans to society members are guaranteed by two sureties, but there is little, if any, group lending except in NWFP for machinery.

Extension workers--AOs particularly--complain that they have a better basis on which to assess credit needs of farmers in their areas than do the Cooperatives Department staff at the equivalent level since they know more about crop input requirements. Cooperatives Department staff, however, point out that they are charged with enforcing certain lending policies and lend only to members of societies. Thus, they feel that extension agents should encourage farmers with seasonal credit needs to seek out the appropriate cooperative agent or to seek membership in a local society. The Cooperative Department prefers that extension agents not come directly to their Cooperative Department counterparts to advise that a particular farmer should be given a production loan.

Coverage by Cooperatives Department staff is usually even less complete than by FAs from extension. Cooperatives staff are even less well-paid than their extension counterparts, and at the field level they have no transportation facilities whatsoever. Yet they are legally required to create and monitor all societies and recover all loans.

Generally, those farmers who complained that they never saw an extension agent--and there are many in both Punjab and Sind--also said that they had never heard from the Cooperatives Department and had never been involved with a cooperative society. Some, at least, seemed to confuse cooperatives with union council and society membership as coterminous.

Cooperatives Department and Federal Cooperative Bank lending regulations prohibit lending to the landless--that is, to tenants and/or sharecroppers. In theory, FAs are addressing the information needs of tenants, but often through contact with their landlords. Tenants do, in some instances, at least make independent decisions about what to plant, and they are also responsible for providing all or a part of required inputs. Thus, tenants and sharecroppers have need of services from both extension and cooperatives.

A donor-sponsored oilseeds project should explore the possibility of starting a pilot lending program for landless tenants and sharecroppers to encourage them to plant nontraditional oilseed crops and improve cultural practices on traditional rape and mustard crops. During implementation, if not before, project management should explore the availability on the ground of small-farmer credit, both through cooperatives and through the new ADBP small-farmer credit program. Large and small farmers currently purchase sunflower, safflower and soybean seed through the GCP on short-term credit. This is probably not the optimal situation and GCP does not provide related credit for recommended inputs. (See Section 5 on "Linkages with GCP.")

4. Linkages to Local Bodies--Union and District Councils

Under the current Local Bodies Scheme, union and district councils are being given increased responsibility for carrying out development projects and activities at the sub-provincial level. The GOP has indicated that new union council elections will be held in 1983. Union councils, which cover an area determined by a combination of population and space, are the only directly representative elected bodies in Pakistan's rural areas. Town and municipal councils provide equivalent representation for urban residents. District Council members are elected by union council chairmen and provide indirect representation as do the provincial councils which rely on a mix of elected and appointed persons for membership.

In Punjab and Sind, FAs are posted in terms of union council areas. AOs in Sind's T&V districts at least attempt to work with union councils in their areas, attending council meetings and providing members with the products of the agricultural information service. In Multan Division, Punjab, members of the district councils are represented on the advisory councils to the extension service at the district level (EADA).

Union and District Council members tend to be large landowners. Reaching them with information about new targets and cultural practices can mean that this information will trickle down to their tenants and to small farmers in the area, especially if these members are among the area's "progressive farmers." As is pointed out in the social analysis report by Tobias and Tabor,* this is often the only way that such information will reach these smaller producers who form the majority of the farming population.

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*See Cynthia Tobias and Steven R. Tabor, "A Social Soundness Assessment," in Part III of this series.

Union and District Councils have the authority to tax within certain limits. They also raise matching funds for a variety of local projects, including public works, that have a positive impact on agricultural production and marketing, i.e., roads, irrigation-related works, bridges, barrages and bunds.

Increasingly, local revenue generation and expenditure will be the responsibility of these local bodies under the new Sixth Five Year Plan. They will thus continue to play an important role on the local scene and, eventually, might be able to sponsor some innovations in the funding of extension services. Ultimately, extension workers could, in time, become partially responsible to local councils or, at a minimum, council members might become involved in evaluating the performance of FAs and their programs. This is one way in which extension might become more aware of and responsive to farmers' needs and priorities.

At present, however, council members, like other large landowners, are often able to arrogate to themselves the majority of available services, both from extension and the Cooperatives Department, as well as from council projects. Ways in which these kinds of abuses can be avoided were the subject of one session at a recent international seminar on Management for Rural Development in Pakistan, held by the Pakistan Academy for Rural Development, Peshawar. This is receiving some attention from the Ministry of Local Government and Rural Development (LGRD), whose local staff are responsible for the smooth functioning of the councils. (The role of LGRD staff is, unfortunately, similar to that of Cooperatives Department staff--it is both supervisory and regulatory.)

Thus, it would be unwise for a donor-sponsored oilseeds project to go too far in loading additional responsibilities on the already thinly-stretched management capacity of the local bodies and the ministry. However, the models provided by Punjab and Sind, as noted here, should be encouraged and expanded to areas where they have not yet been tried.

5. Linkage to GCP

Current linkage to the GCP is almost nonexistent in many areas of Pakistan. The Ghee Corporation does not recognize extension's educational role as important. Extension feels that GCP small-farm crop pick up is undependable and price incentives are not easily modified. A donor funded oilseeds project cannot and should not be expected to correct such a situation but, if implemented, should show awareness of the problem. To a considerable degree, GCP is attempting (with very few personnel) to preempt the role of the extension service. As a provider of seed and marketer of produce it possesses strong leverage with the farmer.

It is important, as stated earlier, that agriculture have an effective extension service, but only one. Therefore, the

Department of Agriculture should develop a monitoring and coordinating capability which will encourage and assist private enterprise to provide oilseeds to farmers. It is also suggested that the research departments be held responsible for identifying the best varieties, and extension be responsible for providing information on cultural practices to the farmer. In essence, this recommendation would confine the GCP role to processing and marketing of edible oils and assign responsibilities for production to Departments of Agriculture. If accepted, this concept would require specific training for AOs and FAs in agricultural economics and marketing of oilseed crops.

Extension service staff, as already indicated, need training on the potential role of oilseed crops in the farming system. They also need to be given the means to communicate readily the problems farmers have with traditional and nontraditional oilseed crops to the GCP field agronomists and the Procurement Division. Farm management and enterprise analysis information is needed on a national basis and should be a part of any such training program.

GENERAL RECOMMENDATIONS

1. Training

Sustained, in-service training is required for effective functioning of any extension service. An oilseeds project should include support to enable the provincial extension services to conduct specific on-going training programs related to oilseed production. Specifically, it is recommended that the project support the personnel of Agricultural Training Industries (ATIs) by adding a training officer for oilseeds to the staff of each ATI. A sufficient operating and travel budget should be added to permit training AOs and FAs at the district level.

2. Upgrading all Extension Positions and Provide Career Incentives

Field assistants (FAs) should be hired initially at Grade 9, with automatic upgrade to Grade 11 after two years of satisfactory performance. Based on performance, participation in in-service training and seniority, FAs should gradually be upgraded to Grade 17 through the creation of a series of intermediate grades. There should also be some incentive for agricultural officers (AOs) to climb above entry levels and a grade promotion for extension officers assigned as instructors at the ATIs, but only if they prove effective as extension staff trainers.

The present system in all provinces of Pakistan provides little, if any, incentive to extension workers to perform well. The salary scales are an open invitation to develop other means of

providing for one's family, lead to favoritism toward large landowners and discourage outstanding young people from considering careers in extension.

3. Provide Office Space and Travel Support for Extension Field Staff

Lack of a central location from which to work is a most serious limitation. Until this is corrected, FAs cannot be expected to perform at effective levels. Bicycles should be provided to FAs at government expense and motorcycles to AOs. Mileage payments to AOs should be prompt and dependable and full, daily allowances should be provded to FAs and AOs when they are away from home.

Progress is taking place in the T&V districts, although in most instances it appears that appropriate house/office site selection within the village has been sacrificed in efforts to acquire free land. Many FA offices are located on big farms. Others are away from the village and in some villages are poorly located. These factors in the Pakistan culture result in FA families refusing to move, even though the facilities are superior to their current homes. Sites should be purchased in appropriate locations within the village.

4. Improve Extension-Research Linkages

a. GOP funding could be provided to support one oilseeds SSMS from the research department who would be assigned to one of the ARFs operated by Extension in Sind and Punjab. A project should assign and fund one expatriate to provide leadership and coordination. Travel to a foreign country should be provided to gain first-hand knowledge of joint research/extension activities. Similar travel should be provided for AOs stationed at the ARIs.

b. Post an M.Sc.-trained AO at each of the ARIs to provide more direct linkage from research to extension. Under an oilseeds project, the assigned AO could and should be supported for specialization in oilseeds research and information flow to extension. One expatriate should be assigned in each province for the first two years to provide counterpart training, general support and enhance linkages. (This recommendation could be carried out in Punjab, Sind and NWFP.) The expatriates should have field experience as country extension directors or as area (multi-county) agronomists.

6. <u>Involve Agricultural Universities to a Greater Extent in Extension Training</u>

Encourage the agricultural universities to participate in developing curricula for the ATIs and supervise examinations so that college credit might be awarded (at least for some of the ATI course work). This would not only initiate a dialogue between universities and ATIs, but also could provide at least some chance for outstanding FAs to become eligible for eventual enrollment in an agricultural university. This would require a change in policy to permit high performing FAs who posted high scores in accredited ATI courses to enroll in the agricultural universities. They should then be allowed to carry forward any college credits attained at the ATI so they might earn a B.Sc. degree and eventually achieve appointment as agricultural officers (AOs). The current, closed system in regard to upward mobility and educational opportunity is considered inconsistent with providing maximum benefits both to the society as well as individuals.

Additionally, the model provided by the NWFP Extension Service, which allows AOs to accumulate earned leave and then pursue M.Sc.-level course work at the Peshawar Agricultural University, could be amended in NWFP and other provinces as follows:

a. Having completed the two-year ATI training course, top performing FAs could, after three years' outstanding service in the field, be permitted to enroll for B.Sc.-level training at their local agricultural universities. Enrollment would be on an experimental basis. Scholarship funds and/or stipends could be provided by the Extension Service for these FAs to spend at least one year at a time at the university--with the next year in service in the fields--until a B.Sc. is obtained. Some arrangement might be sought with the university to give credit for some of the time spent in service in the field, if particular practical activities were carried out and reported on in addition to the FA's usual duties. Professorial monitoring visits to the FA's field areas would be desirable.

b. AOs with B.Sc. degrees could, as in NWFP, go on for M.Sc.-level training at their local agricultural universities, but with their Extension Service providing a partial stipend or placing them on half pay while they are at the university. Again, a one-year-on, one-year-off approach could be taken, and academic credit could be given for special applied research carried out by the M.Sc. candidate while he is in service in the off-year. The thesis topic would be researched while the AO is in his second off-year--that is, back on the job--as has already been done by AOs taking M.Sc. degrees at Tando Jam in Sind. An oilseeds project should provide opportunity for overseas training for a

limited number of these individuals--probably no more than one per province per year.

6. Strengthen Agricultural Information Services

Any future oilseeds project should support a communications specialist in each of the provincial agricultural information services and seek reassignment of information services to the Office of the Secretary of Agriculture. Such specialists should not only help publish bulletins on oilseed crops but train others in information and audiovisual media. The information services currently provide about the only linkage between research and extension; they must be expanded and develop more comprehensive activities if they are to serve extension effectively.

7. Reconsider Rotation Policies for Field-Level Extension Staff

The practice for rotating AOs every three years should be modified to a minimum of five years. There is some modification of this rigid policy in Sind and NWFP, but apparently not in parts of Punjab. AOs working under such a rapid rotation just begin to become fully conversant with the agriculture and people of an area when they are moved. Some rotation is desirable, but not at such frequently intervals.

8. Strengthen Applied Research

At both ARIs and ARFs, there should be applied research in sheep, goat and poultry production to find more effective ways to use meal and other oilseed processing by-products. Existing research in animal nutrition is very weak.

9. Improve Credit Availability for Oilseed Production

Credit for seed for nontraditional oilseed crops should be provided by the normal credit-granting institutions--the ADBP and the Cooperative Banks--rather than by GCP. Extension agents can and should assist Cooperatives Department staff in assessing short-term requirements and in referring small farmers to Cooperatives agents. Cooperatives need to be more responsive to extension recommendations. Some attempt should be made to set up new oilseeds production and marketing cooperatives--the latter as an attempt to overcome the current marketing problems of small producers of nontraditional oilseed crops.

10. Use Cooperatives to Improve Extension Coverage for Oilseeds

Cooperatives Department staff should attend seminars on oilseeds promotion, including the rudiments of production and marketing, so they can inform society members of the

possibilities. Extension agents could then follow-up with more detailed information for interested farmers. By coordinating their work with Cooperatives, farmers could be contacted in groups rather than as individuals.

11. Involve Local Bodies to Advise Extension and Relay New Information to Represented Farmers

District Councils should be represented on extension advisory councils at the district level in all provinces, and Union Councils should be used to disseminate agricultural information at the local level. Union and District Cuncils could thus be used as a channel for getting farmers' expressed needs and priorities to the attention of policy makers in the provincial agricultural departments through their field staff. The councils could also disseminate information from the top down.

Seminars and field days should be held for the staff of the Local Government and Rural Development Ministry, along with those of the Cooperatives Department. These meetings should cover priority issues and information about traditional and nontraditional oilseed crops, as well as results of adaptive research and other extension messages. This is a way of helping the Extension Service attain better coverage rather than duplicate the extension function. Policies which lead ARs to grant the "safest" loans for their own protection should be re-examined.

12. Strengthen the Agricultural Statistics Section of Extension Services

Agricultural statistics officers who have some salary benefits above their same-grade peers who are horticulturalists or plant protection specialists, should be given control over their existing separate budget allocation. They must also be provided with requisite vehicles and funds for interviews and yield measurement. Further, consideration should be given to providing microcomputer facilities for the statistical service which could vastly increase efficiency, reduce overhead costs and assist in preparing data for setting and verifying government crop targets. The present situation militates against any reasonable planning and evaluation in the area of traditional and nontraditional oilseeds production and marketing despite a proposal to begin an "objective survey" including 18 crops in 1983.

13. Increase Farm Management Orientation of the Extension Services

Despite some attention in the ATI training curricula, FAs learn little about enterprise anlaysis, farming systems, farm management and/or agricultural economics. Similarly, B.Sc.-level AOs tend to know little about these crucial topics. These AOs are therefore limited to discrete, technical and often mutually

contradictory recommendations, and to supervisory duties for which they have never been trained. Such limitations in technical information are particularly important where nontraditional oilseeds are to be introduced either on marginal, formerly fallow land, on waterlogged and saline fields, or as a second crop following major field crops such as rice, cotton or wheat. It is also critical for improvement in the production of traditional oilseed crops--rape and mustard--which are often intercropped, as with vegetables or pulses, or allowed to grow as weeds in grain fields. Data to support this suggestion must be developed as part of a program of management and economic data collection.

A rather small variety of biological changes are introduced from research. Therefore, cultural practices, cropping patterns and improvements in farm management are key technologies for extension staff to transfer to farmers over the short and medium term. It is in these areas that FAs and AOs are least well prepared. Appropriate changes in ATI and B.Sc. curricula, as well as revisions in content of Agricultural Information Service Bulletins and multi-media presentations, would help meet this need, as would purposeful recruitment of more M.Sc.-level AOs specializing in agricultural economics.

14. Utilize Female Personnel

Encourge further experimentation with female field assistants and AOs. There is an experimental program in Punjab where female FAs are working at the tehsil level--either directly under their Extra Assistant Director of Agriculture (EADA) or seconded to the Social Welfare Department. NWFP's extension service is interested in putting its existing female AOs to work in the field rather than in the lab. Tando Jam in Sind will be admitting female B.Sc. students for the first time this year.

Most senior extension personnel indicated that:

(a) women play a key role in agricultural production;

(b) male extension agents cannot approach women;

(c) women field assistants and/or AOs would be useful in extending information on farm practices, home economics and safety measures for pesticide use to women involved in the sector; and

(d) despite some real or imagined cultural inhibitions, women extension personnel could do a good job at the field level.

Some senior personnel indicated that under Village Aid (a donor-sponsored program) women Community Development (CD) workers had had excellent success, including home economics at the village level, and that extension should either return to its former

policy of including home economics and nutrition (in some provinces) or institute such a policy for the first time.

During discussion with the Director General, Extension, NWFP, the hope was expressed that both present and future donor-supported oilseeds projects could provide stimulus for reinstituting admission of women to the Agriculture University at Peshawar. This would provide more qualified women agriculture graduates to work at the field level--both in extension and in research.

APPENDIX 1

Organization Chart

Extension and Agricultural Development Project, Punjab

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                     Director of Ag Extension
                              Multan                    MULTAN REGION
                    Cotton Maximization Scheme
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                                 |
                       ---------------------
                       Deputy Director of Ag          District
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                                 |
                                 |
                                 |
                  -------------------------------
                  Extra Assistant Director of Ag      Tehsil
                  -------------------------------
----                 |           |
APPO----------------             |
----                             |
                            ----------
                            Ag Officer              Markaz
                            ----------          (4-5 Union Councils)
                                 |
                                 |
                                 |
                          ----------------
                          Field Assistants-------|
                          ----------------       |
                                 |               |
                                 |               |----Union Council
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                              -------            |
                              Beldars------------|
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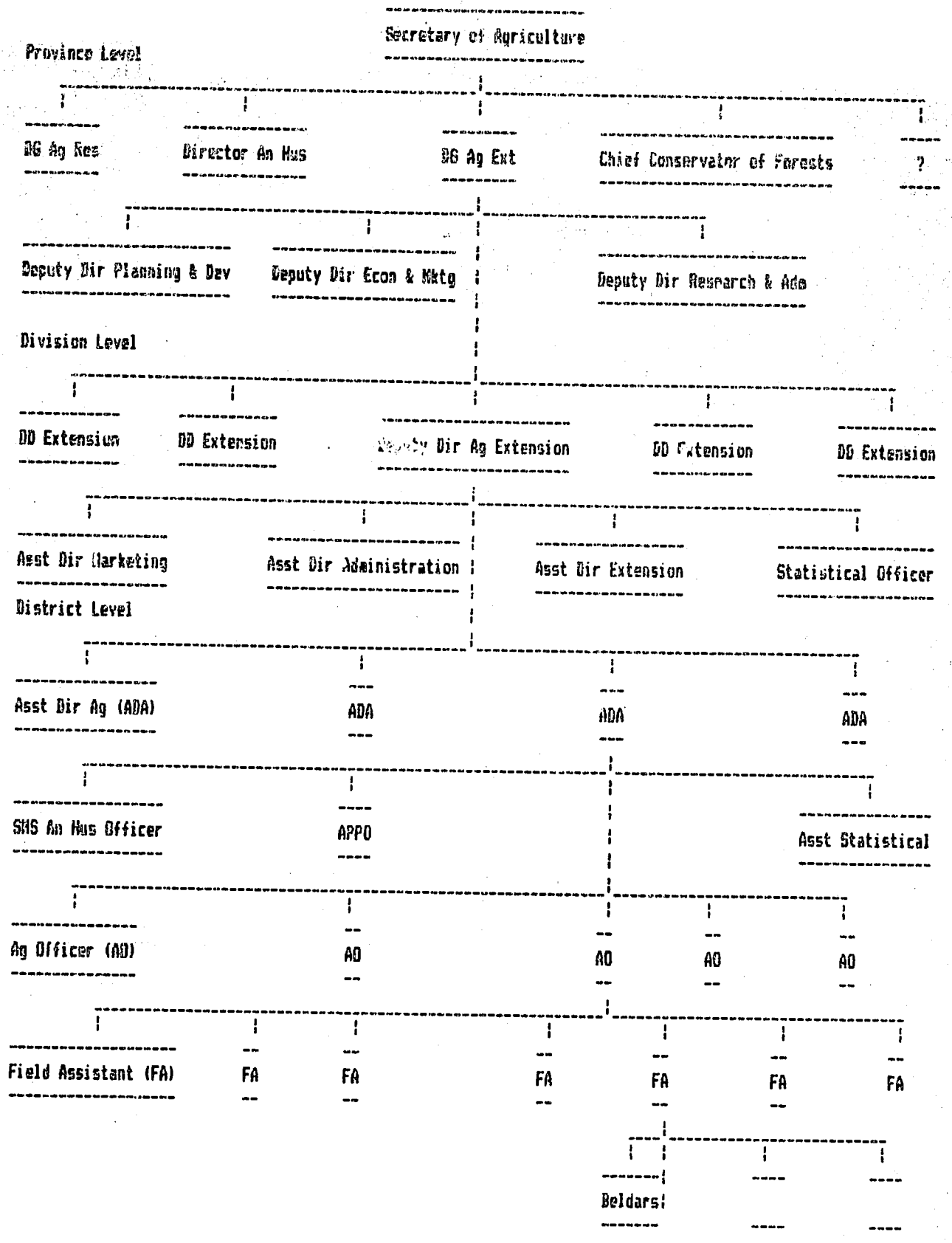
APPENDIX 2

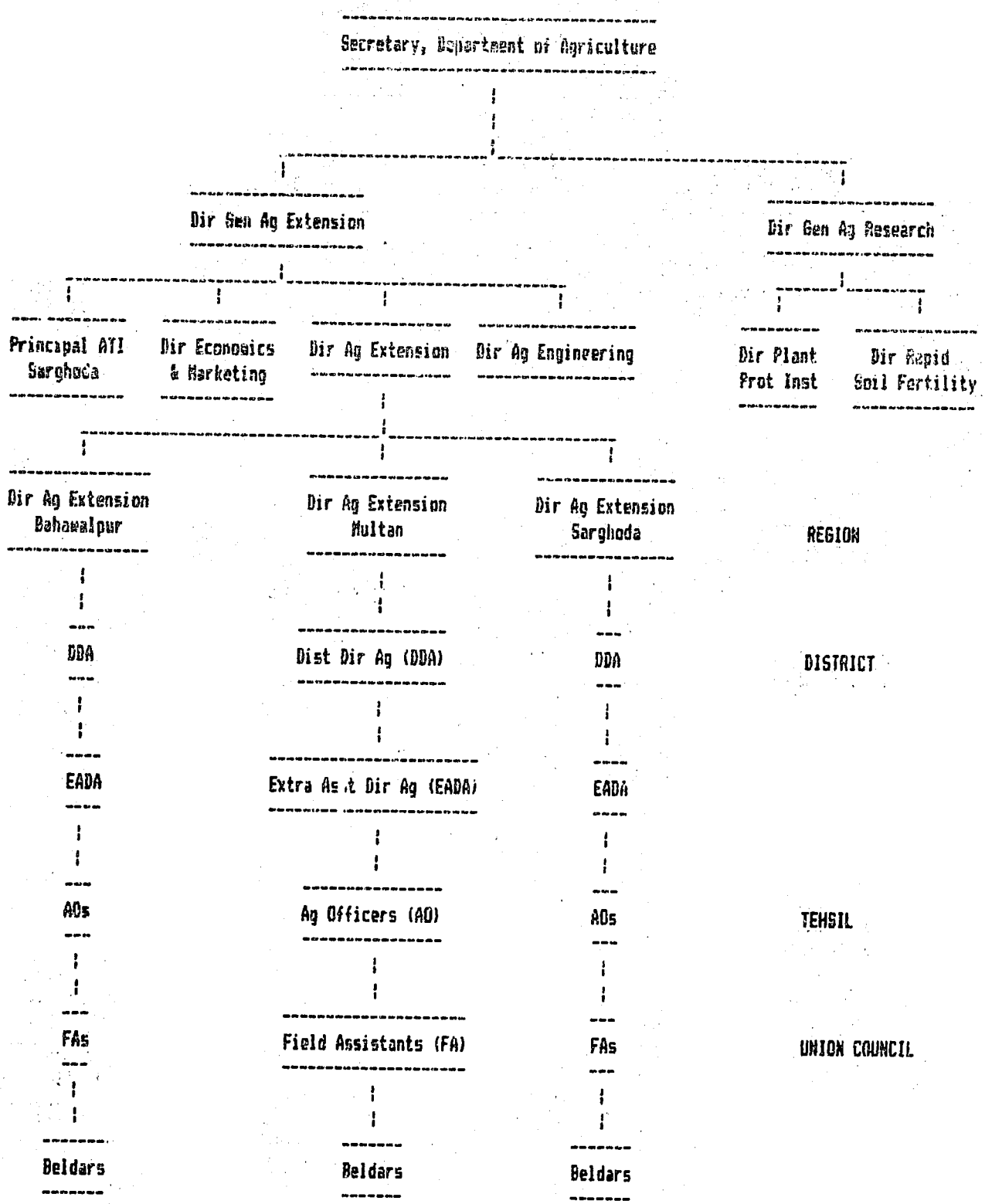
Organization Chart, Agricultural Extension Service, NWFP



APPENDIX I

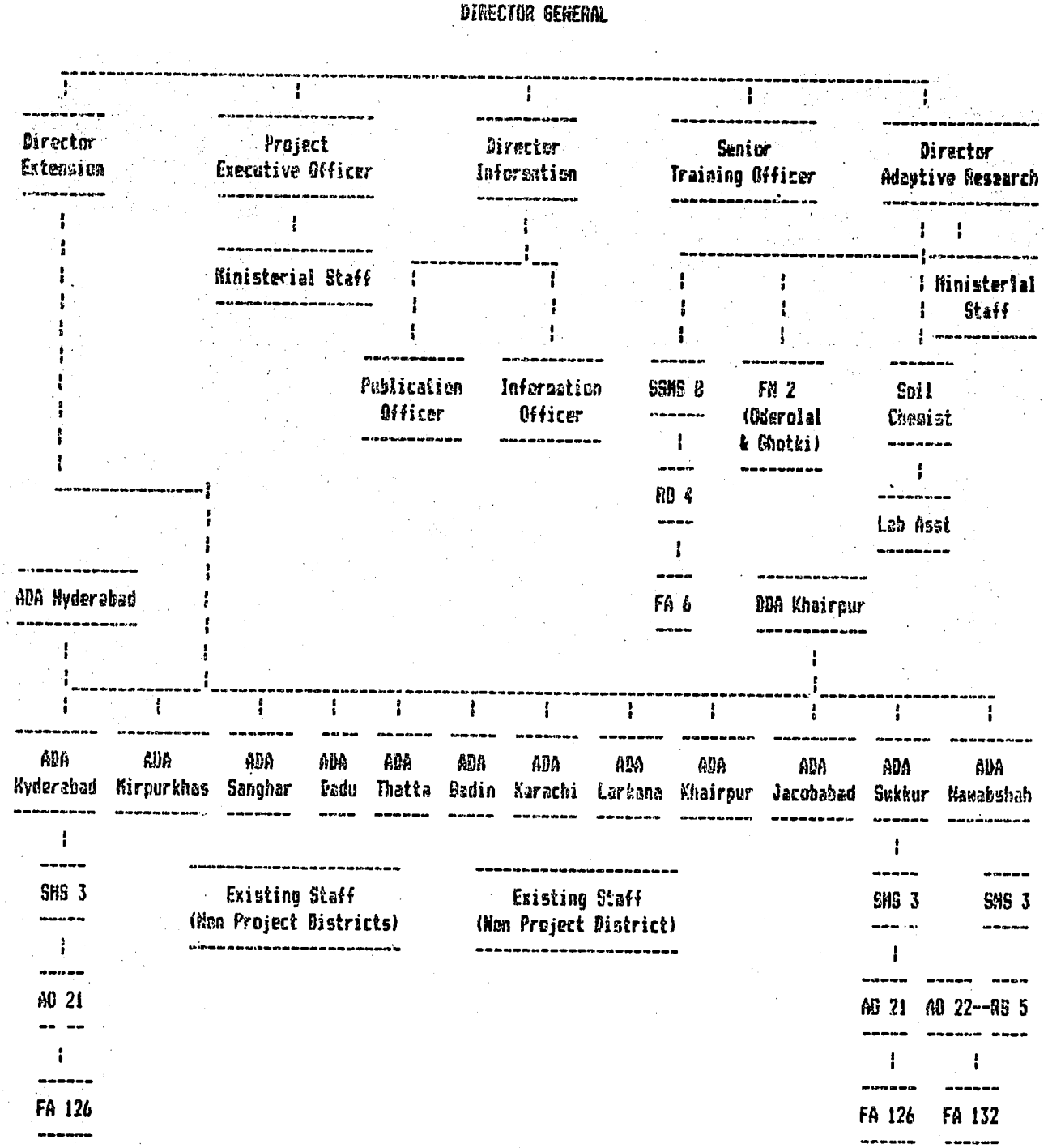
Organization Chart

Agricultural Extension Service, Punjab



APPENDIX 4

Organizational Setup of Sind Agriculture Extension and Adaptive Research Project 1980-81, According to SME

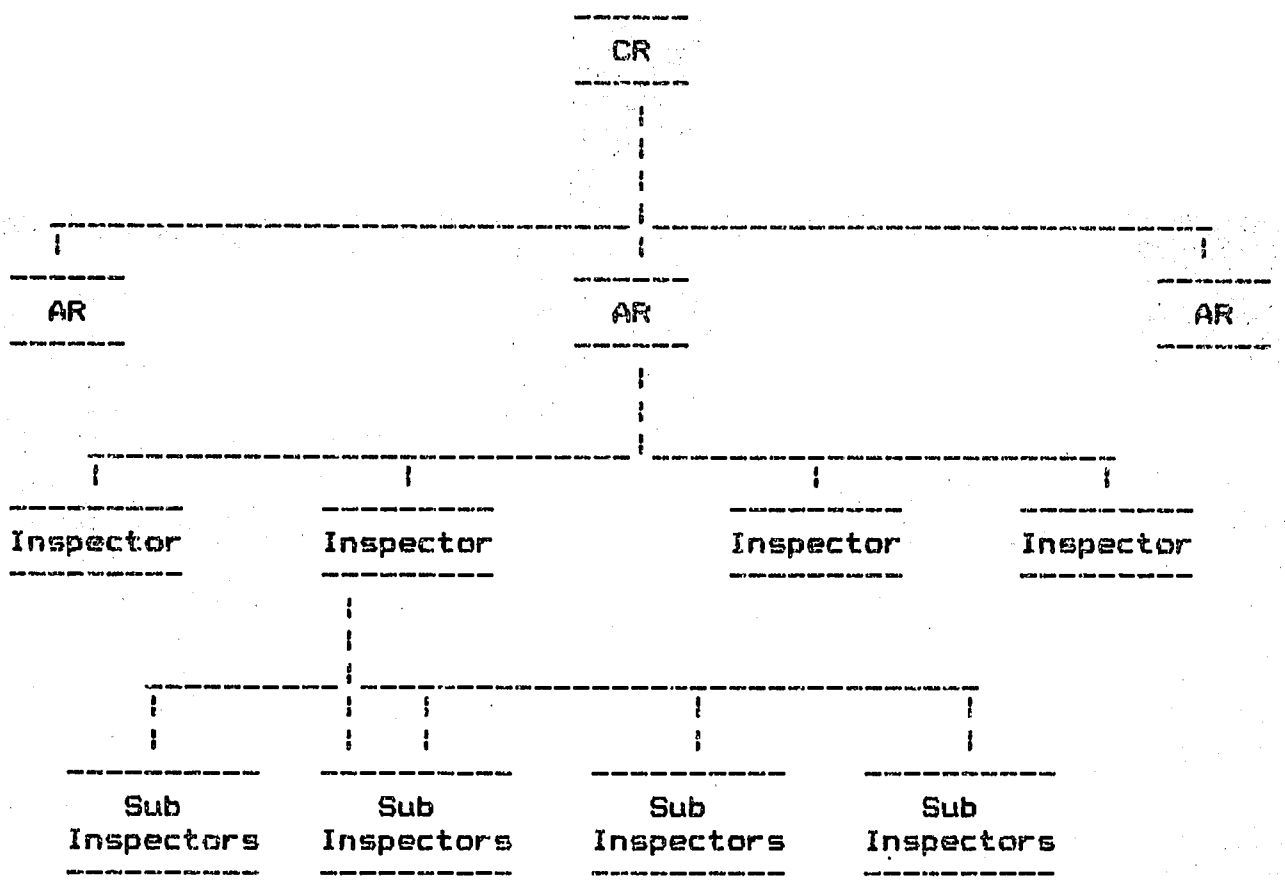


References:

SSMS = Senior Subject Matter Specialist
SMS = Subject Matter Specialist
RO = Research Officer
AO = Agriculture Officer
FA = Field Assistant
DDA = Deputy Director of Agriculture
ADA = Assistant Director of Agriculture
FM = Farm Manager
PS = Pest Scouts

APPENDIX 5

Cooperatives (Co-ops)



ADDENDUM

Alice L. Morton

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I. Training

The recommendation on the training of FAs was based on a synthesis of suggestions (and, to some extent, objections) from various persons interviewed. The premises underlying the recommendations are:

1. that FAs need incentives and motivation in order to do a better job; and
2. that further training and educational opportunities may, if properly handled and linked to promotional opportunities, provide such incentives as well as enhance the FA's outreach/extension capability.

At present, FAs are recruited after ten years of schooling--they are "matriculants." They are then given two years' training at an Agriculture Training Institute. This training primarily includes "scientific" (biology, soil science, agronomy, horticulture) training along with some fragmentary exposure to marketing, institutional and sociological issues and economics. Experienced informants indicated that exposure to the latter fields is quite sparse and is less useful and thorough than a glance at the curriculum might lead one to believe.

After the two-year training period, the FA is posted to the field at Grade 5. He then has no opportunity for further formal training nor the ability either to pass an FSc exam which would mean that he has finished the equivalent of a "college" course, or to enroll at an agricultural university. In Pakistan, course work for such exams can be pursued privately, but this does not seem to be done by FAs, with the exception of the Lady Field Assistants in Punjab who are doing FA exams of their own (not to be confused with "FA" as in field assistant).

The recommendation suggests that ATIs be linked to the more usual educational system to the extent that course work at ATIs be counted as part of the requirement for college completion--the FSc. In order to achieve this, it is probable that additional required courses would have to be offered at the ATIs--Pakistani and Islamiat particularly--where these are not already offered, as well as English and Urdu. These four courses are required for all college graduates. Further requirements vary given whether the FSc student is pre-medicine, pre-engineering, or other, e.g., arts. There is no pre-agriculture course curriculum. Pre-agriculture students follow the pre-medicine course plan.

It used to be possible in agriculture, as opposed to other subjects, to enter the agriculture colleges (then universities) after matriculation if exam marks were good enough, and then to spend either four years to obtain a BSc degree or five years for a BSc (Honors) degree. This is no longer true. In some cases,

students who have taken two years of the pre-engineering FSc exam, but who are not admitted to the engineering universities, enter the agriculture universities and then spend either two or three further years to obtain their agriculture degrees.

The recommendation further implies that there should be some linkage between the ATIs and the agriculture universities which is presently not the case. The ATI teaching staff are neither recruited from university faculties, nor are they given any teacher training or substantive course work at the university level no matter how old their degrees may be. Extension education departments at agriculture universities have so far not provided any short courses or refresher courses for ATI staff or other extension staff. Rather, they appear to be restricted--where they are operative at all--to providing courses for teachers in other fields.

University faculty members might be asked to give at least some of the courses at the agriculture universities. A further possibility is providing some university-level courses at the ATIs for experienced FAs and AOs in fields they have had little exposure to, such as farm management and agricultural economics. This would help the extension services to maintain a hold on in-service training for extension so that such training would not become even more theoretical than it already is, as would likely be the case if the job of curriculum development and supervision were given over to the universities. If agreement cannot be reached with the agricultural universities, the possibility of using the open university might be explored.

The objections raised about this recommendation when discussed with university and agriculture department staff were:

1. The university faculty and administrators were afraid that letting FAs into the universities would water down quality--presumably of the student body and of the courses.

2. If FAs were allowed to believe that ATI training made them equivalent to FSc-holders, they would then militate for job and educational eligibility beyond their competence and rights. (A similar situation in the technical schools was cited as having created many problems.)

Nevertheless, there is a serious need to improve the training of FAs and to provide them with further educational opportunities during the course of their careers. A number of extension staff in all provinces visited indicated that even if this means that a number of FAs will utlimately leave the extension service for better jobs and "greener pastures," they will still be working in Pakistan and in agriculture, thereby losing nothing.

Regarding the training of AOs, the same sort of logic applies--better trained AOs can and will leave the extension service, especially as the private sector increases its activities in the agriculture sector.

A related sub-recommendation might be to end the policy in Punjab and particularly in Sind, of recruiting (who have gone straight through the agriculture universities from the BSc to the MSc without any intervening practical experience. There is general consensus that this university training is extremely theoretical, that it relies primarily on rote learning and that the degree-holder needs at least one year of practical field experience in service before he is useful. A better policy would be to recruit BSc or BSc (Honors)-holders as AOs, placing them in the field and then, based on performance, selecting the best for MSc-level training in line with recommendations in the preceding Watts-Morgan paper.

II. Conditions of Service

Admittedly, the conditions of service of extension workers provide disincentives to good work and job satisfaction. However, the picture is not quite so bleak as the previous discussion and recommendations might suggest. That is, even FAs, and especially AOs, through the system of annual increments, wind up eventually being paid significantly more than their grade level would indicate. Yet the matter of grade, in addition to actual pay, is apparently significant. If one is a "gazetted" officer--Grade 17 and above--there are at least some benefits that are not available to Grades 16 and below--particularly the right to a vehicle (other than a motorcycle), a telephone and training at one of the NIPAs or other management training institutes. Grade 20 officers and above have the right to further benefits, including servants, cars and free utilities. Thus, if an AO remains at Grade 17, even if his salary eventually goes up, unless he achieves higher and higher grade status he will not be eligible for these remunerative benefits, higher social status and eligibility for higher positions in the service. (There are, however, cases in which one is promoted to a more responsible position but is maintained in the same grade.)

The Watts-Morton recommendation also refers to the importance of mobility--the availability of transport. A recommendation that should be considered in an oilseeds project to provide vehicles without discriminatory allocation and to save extension service money is as follows:

1. Bicycles, motorcycles and four-wheel drive vehicles should be provided to extension agents and administrators on a hire-purchase basis. The officer pays back the cost of the vehicle over time, enabling the service

to purchase another vehicle. If an officer retires or is transferred he should be able to continue to pay off the cost of the vehicle and take it with him. Given the average life of vehicles, a new one would probably have to be purchased for his successor in any case.

2. In addition, the officer should be given a certain amount for maintenance and for travel allowance at a flat rate established as an average for the duties of that category of officer, e.g., 500 rupees a month. Out of this the officer might hire a driver if he needed or wanted one. In this way, at least two things will be accomplished: (a) the extension service would not be responsible for maintaining a fleet of drivers as well as of vehicles and (b) officers would be encouraged to drive themselves. Additionally, time, morale and money would be saved by eliminating technical assistance and maintenance bills. In the present circumstances, there is usually at least a gap of a month or two before any of these bills are paid. Frequently they are never paid in full; sometimes, they are carried over from one fiscal year to another.

III. Linkages with Local Bodies

It is recommended to use district council members as part of an advisory council to the extension service at the district level. This is done in many parts of Punjab. Eventually, AOs and FAs might become responsible to the union and district councils in their areas of operation. Further discussion with extension administrators after the Watts-Morton report was written led to the conclusion that this is probably more feasible and feasible at an earlier time than was originally thought. Since FAs are posted at the union council level in three provinces--and it was recommended that they be rotated later and less often--the conditions are already there to make an experiment in this direction.

There are a number of subcommittees of union and district councils, including those in charge of family welfare and income-generating activities. It seems quite possible that some of the union councils with more advanced management skills could establish agriculture committees which could then be a point of concerted contact with FAs and/or AOs. Something like this appears to happen in some of the T&V districts, at least in Sind.

Since there is very little evaluation of extension staff, some evaluative and monitoring inputs by farmers themselves, instead of or in addition to the T&V approach, would probably be quite useful. Such evaluations would have to be forwarded to the officer with the right to recommend promotion (or demotion) of the evaluated individual. If this kind of approach were taken, a

further recommendation would be that the extension agent assigned to a union council area, or preferably to a village, would undertake a benchmark survey so that whoever was evaluating his progress would have something to go on. The agent would also be required to keep a record of progress on the part of each farmer he works with and then record his own activities as well (this is a version of the diary in the T&V system). Together, these activities would provide the basis for evaluation.

At present, except for the T&V districts, there are really few criteria for evaluation except the extent to which overall crop production in the agent's area increases. As administrators admit, this is hardly a fair criterion since there are so many variables that are beyond the agent's control. For evaluation of this kind to be worthwhile, there has to be a resulting benefit to the agent if his evaluation is positive--training opportunities, salary increments or grade promotion.

There is presently little opportunity for merit promotion. However, some possibilities exist and these could be enhanced and extended. Similarly, even a regional extension director cannot demote or dismiss an officer serving under him. He can, apparently, recommend that such a person be transferred to another region and he can transfer people within the area over which he has supervision, but he cannot hire or fire. While it is unlikely that such powers will be decentralized even to the regional level, some encouragement should be provided by the concerned donors in this direction, but with a more positive approach to promotion in terms of meritorious performance.

IV. Linkages with the Private Sector

The Watts-Morton report says relatively little about private sector options in extension, nor does it say much about relations between the public sector extension service and private organizations in the agriculture sector. There are several things that might be said.

1. In terms of linkages between extension and the GCP, the report suggests that GCP should get out of the extension business as well as out of the crop-lifting business. However, since it is not a marketing report, it does not include suggested options for marketing. Certainly, the extension service should not be in the business of lifting crops and should, as is noted, stay out of the input supply business which is now tapering off. However, the extension service might have some involvement in marketing by identifying suitable commission agents or shopkeepers who could be licensed to procure oilseeds, especially from small farmers. In

reality, this is already happening, and farmers who have some rapport with extension agents are seeking their help in pressuring the GCP as well as local buyers to help them sell their nontraditional oilseed crops.

2. AOs at field level (district level) should carry out timely surveys of the availability and demand for inputs and should then inform the private input suppliers of their findings. From observation, AOs are perhaps underemployed some of the time, but they could well become overemployed if they did all they were supposed to do.

   AOs are, meanwhile, not taken very seriously and from observation, the private sector agents of pesticide and fertilizer firms are to some extent competing with the AOs and certainly with the FAs. This is particularly true where these agency-owners are themselves medium to large-scale farmers. People come to them for agricultural advice apart from that which relates strictly to the inputs they are marketing.

   At the time of an interview with a medium-scale farmer in NWFP who represents a pesticide firm locally, there were 12 farmers waiting to talk to him about input needs, crop diseases and cultural practices, generally. One of these had tried to talk to his local FA who had turned him down flat, and then had come 12 miles to town to talk to the FA's supervisor, the EADA, who gave the same response. Finally, he came to this agency-owning farmer who treated him courteously, listened to his problems (cut-worms on onions), made sure that he did not have any further related problems and sent him away with (apparently) the appropriate insecticide. The farmer was quite vocal in pointing out how much of a difference there was between this treatment and that he had received from the extension service. The agricultural and research staff at this interview concurred.

3. Discussions about the use of pesticides with extension administrators suggested serious health and safety problems. These extension officials were sympathetic to the idea of using lady field assistants to extend information campaigns to housewives and women involved in field agriculture about dangers associated with pesticide use. In NWFP, the representative of a pharmaceutical firm which is marketing pesticides through private agency-holders was asked what he thought about having firms like his carry out this task. His first response was that such a program was a good idea, but this was immediately followed by the suggestion that the public sector extension service should do the job since they had the staff and the

funds, while his firm was new in this business. This was not an atypical response.

The response of large farmers who do not need credit that they want credit for seed and for inputs in order to try out nontraditional oilseed crops was not unusual. Most people interviewed thought that the old seed for seed exchange form of credit was preferable to the current ADCP credit policy for seed, and also pointed out that credit for seed was not as useful as credit for other related inputs would be. The extent to which interest-free "Islamic" credit can or should be offered by private sector companies, along with extension services, should be further explored, especially with regard to the adoption and expansion of nontraditional oilseed crops.

V. Credit

The Watts-Morgan report makes certain points about the non-availability of credit for inputs through the institutional lenders for small farmers and tenants. Since that was written, further interviewing has indicated that this is indeed a problem. In the Multan region, however, there is apparently a new program to make short-term, seasonal loans to some tenants through the Agricultural Development Bank of Pakistan (ADBP) if two guarantors are made available for the tenant. Whether or not this program is specific to this region or more general was not determined.

Meanwhile, further interviewing also established that in many cases, especially in NWFP, but also in other provinces, tenants do decide what to plant, including nontraditional crops like oilseeds. This is particularly true where large landowners are involved and where holdings are fragmented. The owner simply cannot supervise all his tenants and does not seek to do so. He lets the tenant decide what to plant and hopes that he will get adequate rent or an adequate share of the crop. Increasingly, owners prefer cash rent to shares of the crop and this may present increasing difficulties to cash-poor tenants and small farmers who rent some land and own some. This, in turn, will probably lead to more credit needs on their part. Owners who encourage cash rent rather than sharecropping and do not supervise are unlikely to pay for a share of the required inputs for tenants' fields, although this has been the norm in the recent past where shares were involved.

VI. Women in Extension

It should be stressed that there is a role for women in extension in Pakistan, that it is not limited to home economics and that the involvement of women in agriculture at the field level is not by any means limited to Punjab. Women have a considerable amount of influence on decision making about new risk adoption, especially where extra outlays for labor are concerned, as is often the case with nontraditional oilseeds. They also make decisions about home oil/ghee consumption which has implications for related decisions about oilseed crops.

COOPERATIVE FARM CREDIT IN PAKISTAN

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March 16, 1983

I. Methodology

Very little information is readily available on the cooperative movement in Pakistan. Field trips to three of the four provinces were arranged for collecting data on the cooperative movement in general and cooperative agricultural credit in particular. Appointments were made with individuals at various levels of the movement. Provincial registrars, joint registrars, provincial banks for cooperatives, branch cooperative banks, cooperative societies and cooperative training colleges were called on to ascertain their level of cooperative knowledge and training. Particular attention was paid to cooperative credit societies because they are the sole source of institutional, short-term agricultural credit for their members.

Various observations, problems, solutions and recommendations were discussed with the Bank for Cooperatives and Cooperative Department personnel on an informal basis to make certain the proposed report would be accurate and either concur with current GOP policy or have a reasonable assurance of gaining GOP acceptance.

II. Cooperatives in General

Punjab Province contains the vast majority of cooperative activity. In that Province, according to the latest statistics, there are 36,469 agricultural and 4,767 non-agricultural societies. Total membership is 1,918,134. A mathematical calculation tells us that the average size of an agricultural society is 39 members, which is far too small to be economically viable. Discussions with key departmental personnel reveal that they are aware that perhaps as many as one-half of the agricultural societies could be liquidated if economic viability were the only consideration. It is readily admitted that the optimal size of membership is probably between 200 and 300.

Having the above numbers to deal with creates a myriad of staffing problems in the Province, which contains about 50,000,000 people. The Cooperative Department field staff at the district level and below includes 27 registrars at district level, 80 assistant registrars at tehsil headquarters and 295 inspectors supervising 1,100 sub-inspectors who are located at the union council level. The grass roots responsibility for cooperative education and supervision is at the sub-inspector level. Simple division then indicates that each sub-inspector is responsible for 33 primary cooperatives, a Herculean task for someone with the lowest pay scale in the civil service and who lacks any means of transportation.

III. Cooperative Agricultural Credit

Cooperative Credit Societies have two main sources of credit available to their members. The societies' own funds are derived from a two percent commission, savings and surpluses. These funds may be advanced for productive or consumptive purposes. Gold and silver may be used for collateral as well as real estate. Borrowed funds are obtained from the Provincial Cooperative Banks through their branch banking system. The Provincial Cooperative Banks, on guarantee from the Provincial Administration, obtain funds from the Federal Bank for Cooperatives whose funds in turn are derived from the State Bank of Pakistan.

Prior to December 1976, credit societies were cooperative banks. It was wisely decided to consolidate the cooperative banking system and the Federal Bank for Cooperatives Act, 1977, created the present system and eliminated the use of societies as banks.

As an example of the magnitude of the banking system, Punjab Province can be used. The Provincial Bank for Cooperatives maintains 141 branches and has approximately 25,000 affiliated societies, 16,000 of which are participating credit societies. Their staff for the headquarters and branches numbers about 1,000. During the winter (rabi) cropping season, Rs. 729,000,000 ($57,000,000) was extended as in-kind credit. Their loan repayment rate of 95 percent attests to their current ability to collect these loans.[1] This repayment rate, however, is not indicative of the repayment rate in the country as a whole. Perhaps as much as 80 percent of the total cooperative business is conducted in Punjab, so its importance in the movement should not be minimized. If a person is inclined to build on strength, Punjab is where the foundation has been laid.

IV. Cooperative Banking

The existing cooperative banking system provides an adequate, dependable source of short-term, production credit to members of registered cooperative societies. Non-members can reportedly borrow from the Agricultural Development Bank or from commercial sources. The adequacy or dependability of these sources was not investigated.

Cooperative loan funds flow as follows:

1. Members apply to their societies for loans.

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[1]See Appendix I for five-year loan chart.

2. Societies apply to the Provincial Cooperative Banks through their branches.

3. Provincial Cooperative Banks bulk loan applications and request funds from the Federal Bank for Cooperatives.

4. Funds for the Federal Bank for Cooperatives come from the State Bank of Pakistan.

Guarantees are made by the farmers themselves through pledging of real estate and/or gold as security and through the provision of two sureties or co-signers. The society itself must guarantee the bank loan; the provincial government guarantees the loan at the provincial bank level. Despite all these guarantees, not one instance was found where the guarantors had been forced to make payment on a defaulted loan. Many cases were found where loans were extended for up to three years to avoid categorization as "defaulted" loans. Contrary to experience in other developing countries, it appears that the most successful loan collection program occurs when loans are granted to farmers who own 12.5 acres or less and use family labor.

V. Credit Decision Making

The authority for granting, supervising and collecting loans appears to be severely fragmented. One of the fundamentals of credit issuance is not being followed in most instances. This fundamental is that the individual or body that is responsible for borrower selection must also be the same individual or body that is responsible for loan collection.

No clear policy on the process of borrower selection using simple criteria was found. These criteria should include the three basic requirements of successful lending. These basic requirements, in order of importance, are as follows:

1. **Character.** Someone with intimate knowledge of the individual borrower must be able to determine if that individual borrower <u>wants</u> to repay the loan. His integrity must be impeccable and he must feel morally responsible for the orderly repayment of the debt as contracted.

2. **Capacity.** The borrower must be <u>able</u> to repay the debt. Loans cannot be made to raise a farmer to subsistence level. It is only after subsistence level has been reached that successful agricultural lending can occur. Successful agricultural lending can be defined as follows:

The productive capacity of the borrower must be increased to a point where surplus income for improvement or savings are created after payments for ordinary living expenses, operating costs and retirement of principal and interest have occurred.

3. Collateral. This is the least important of the three basic requirements. Loan collection using collateral is neither desirable nor practical in most cases. If proper attention has been paid to numbers one and two, the use of number three does not arise.

During the course of field study, civil servants of all levels, management committees, boards of directors and society members were interviewed to ascertain their feelings regarding borrower selection. Many different views were expressed, some of them worthwhile and other quite harmful to the success of the cooperative credit program. The most dangerous view is that anyone belonging to a cooperative society has the right to receive a loan and if it is not repaid, you can rely on the collateral for collection. The most sensible attitude toward lending appears to be at the grass roots where management committees (loan committees) readily admit that there are some members who should not receive loans because they are not good people (character assessment) or they are not good farmers (capacity to repay is limited).

Being judged by a committee of your peers or, in some cases, superiors creates problems for all parties. It would appear that in Pakistan very few of these decisions not to lend are handled at primary society level. The responsibility for loan denial is passed upwards in the lending bureaucracy with the expectation that "someone else" will recognize the bad loan and deny the application.

Theoretically, borrower selection and loan collection responsibility lies with the management committee of the credit society. Generally speaking, these committees are untrained in this decision making process and have no hard and fast rules, regulations or instructions as to how their task is to be successfully accomplished.

VI. Cooperative Training College

Cooperative training colleges in Faisalabad, Hyderabad and Peshawar were visited. Special attention was paid to the physical facilities, qualifications of instructors and quality of instruction. In addition, the curriculum, teaching technique and

availability of resource materials and textbooks were assessed.

The most in-depth study of the cooperative college system was undertaken at Faisalabad which serves Punjab Province. There are 13 teaching staff members including instructors and lecturers. They can accommodate approximately 150 residential students at one time in their hostel. The principal has been at the college for 22 years, which is unusual. He was formerly an assistant registrar and deputy registrar. The instructors and lecturers have been recruited from the field and have had no special training in methodology or technique. Staff morale appears to be low, largely because no incentives or allowances are provided. Being posted to the college is considered to be something less than desirable.

The various residential class compositions are as follows:

1. Assistant registrars/inspectors (7 months)
2. Sub-inspectors/sub-inspectoresses (6 months)
3. Accounts clerks (5 months)
4. Managers/assistant managers

Course syllabi include: cooperative law, general law, bookkeeping, principles and practices of cooperation, business management, accounting, community development and economics and banking.

Students attending the assistant registrar, inspector and sub-inspector courses are civil servants. The majority of the managers, assistant managers and clerks are recruited from the movement itself.

In addition to the residential courses, the principal is also responsible for the education of officers and members of cooperative societies. Educational inspectors and educational assistants conduct one to six-day courses at the societies on a voluntary attendance basis. Given the number of societies, it is highly unlikely that his field education program has had much impact on the cooperative education level in the primary societies. All departmental field staff should become the educational arm of the movement, instructing committee members and ordinary members in the course of their regular visits.

While the course of study appears to be academically sound, there are shortcomings in the area of credit issuance. The basic principles of borrower selection and loan collection are not taught, nor is reference made to the necessary ingredient of agricultural extension advice as a means of insuring a dynamic credit program.

All three of the cooperative college libraries that were visited were in need of help. Most had not received any new books or periodicals in the last several years and storage cupboards were locked. There is genuine interest in upgrading library facilities. Text and reference books would greatly benefit the colleges in particular and the movement as a whole.

VII. Audit

Lack of time prevented any in-depth study of the audit system. The cooperative unions (mini-alliances) are provided with the audit arm of the movement, but auditors (sub-inspectors) are administratively responsible to the Cooperative Department. The societies that were visited all had current audits. Some audits were said to be completed in five minutes since there is no activity from year to year. Those societies should be discontinued.

VIII. Conclusions

Generally speaking, the cooperative movement in Pakistan has been imposed on the rural areas rather than being formed spontaneously to satisfy a need for members. Whenever the need to implement government policy arose, a new type of cooperative was formed. In Punjab, for example, there are 27 different types of cooperatives. Undoubtedly, there is an overlap in membership that could be avoided with the formation of multi-purpose cooperatives. A move in this direction will probably occur as cooperative education and extension programs become more sophisticated. Discontinuance of moribund societies should be encouraged and mergers promoted.

Staff shortages and lack of transportation for field staff are the main constraints on improving supervision, education and audit. Low basic pay scales and a shortage of funds to pay allowances seriously affects staff morale. While in-service training is a part of the cooperative colleges' responsibility, only about six percent of the Cooperative Department staff can annually attend courses due to a lack of accommodation. This means that the average employee can attend in-service training courses only every 16 years, which is inadequate.

Cooperative credit is the only organized system that can provide agricultural inputs on a dependable basis. This system seems to be very loosely organized and weakly supervised at all levels. Despite its shortcomings, it is extremely successful in some geographical areas. The main constraint on achieving general success is the borrower selection process.

The General Manager of the Federal Bank for Cooperatives stated that the cooperative lending system handles about 20 percent of all agricultural credit; 80 percent of this is for production credit. Adequate loan funds are available from the State Bank of Pakistan for the foreseeable future. If the lending mechanism were streamlined to shorten the pipeline, the resulting efficiencies would free additional funds. As an example, Sind Province only drew about 30 percent of their approved line of credit due to delays in the loan approval and guarantee mechanism. When production credit is required for oilseeds production adequate funds will be available through the existing cooperative chain to respond to members' needs.

During the course of field study, a respectable amount of cooperative literature and publications was obtained. The Cooperative Societies Act, various model bylaws, annual reports and cooperative rules are available.

IX. Recommendations

Any oilseeds production project must contain a provision for the extension of "in-kind" credit for the required farm inputs. It would be highly desirable, if not essential, to strengthen the existing system whereby short-term, agricultural loans are extended to small (12.5 acres or less) farmers. The following recommendations are made with that objective in mind.

1. Agricultural extension advice on the growing of the proposed oilseeds should go hand-in-hand with the issuance of in-kind credit to members of credit cooperative societies. Prior to the growing season, the extension agent should meet with the management committee and the board of directors of the society. Cooperative Department staff should also attend. Simple loan packages should be developed as a means of estimating the individual loan requirements of the farmers and, hence, the bulk loan requirements of the society. The agricultural extension agent must make certain that he is not involved with borrower selection, nor should any attempt be made to involve the agent with loan collection.

2. A simple, brief credit manual should be written and made available in the vernacular languages. This manual should contain policy relating to the extension of credit as well as simple instructions on making sound credit decisions and loan documentation. The manual should be available to all administrative and field staff of the Cooperative Department as well as the cooperatives themselves. It could be used in cooperative colleges as the basis for teaching "small

farmer credit through cooperatives." A skeleton outline of such a manual appears in Appendix II of this report.

3. In the Watts-Morton* paper on agricultural extension, reference is made to the need for support of an expanded agricultural information service. This service is proposed to be attached to the office of the Secretary of Agriculture at the provincial level.

   The terms of reference for the expatriate and Pakistani staff should be broadened to include a provision for a department within the extension service to produce cooperative films, slides, transparencies, charts, graphs, pamphlets and newsletters. These materials should be distributed by the provincial cooperative unions to cooperative colleges, training institutes, cooperative banks, cooperative societies and departmental staff.

   Currently, cooperative unions are producing a limited amount of education materials but all of the printing is done by commercial job printers. The information service should utilize the existing translation expertise of the unions.

4. Technical and financial assistance is required to update and organize the libraries located at cooperative colleges and some cooperative unions. A survey of the present libraries should be made to determine how much of the existing material is obsolete or not relevant. The short-term consultant conducting this survey should then be in a position to recommend the quantity, type and cost of new publications to update the existing libraries.

5. Training aids such a flip charts, overhead projectors, slides, films, projectors and graphs are virtually nonexistent. There is need to supply a limited amount of such hardware together with training on its use. The training should be provided to cooperative college staff by the proposed Agriculture Information Service.

6. There has been only minimal contact with cooperative movements outside Asia. It would be extremely advantageous to the movement in Pakistan if a limited number of participants from the Cooperative Department could study cooperative movements with emphasis on farmer credit and farmers home administration at cooperative

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*See Lowell H. Watts and Alice L. Morton, "Policy, Organization and Management of the Extension Service of Pakistan," in Part III of this series.

training centers in participant donor countries. Provincial registrars are not the right personnel to be selected for this training. There is a tendency for them to be given cooperative duty as a civil service appointment without their having any prior cooperative experience. Participants from each of the provinces should be selected from the cadre of deputy registrars.

The following is suggested donor expenditure for cooperative support.

1.	Short-term consultant, one month to assess cooperative library and training aids needs.	$ 10,000
2.	Commodities. Books, training aids, audiovisual equipment, publications and subscriptions for the Agricultural Information Service and cooperative colleges.	$200,000
3.	Participants training. Four participants for six weeks each. Selected from deputy registrars in the Cooperative Department to study cooperatives with an emphasis on credit. Suggest thorough study of farmers home administration and farm credit administration at Production Credit Association and Federal Land Bank Association level.	$ 40,000

APPENDIX I

Table 1

Cooperative Agricultural Credit Advances and Recoveries
Punjab Province

Crop	Year	-----Thousand Rupees----- Advanced	Recovered	Percent Collected
Kharif	1977	38,698	38,264	98.8
Rabi	1977/78	51,800	50,286	97.1
Kharif	1978	60,000	50,866	84.8
Rabi	1978/79	199,271	193,184	96.7
Kharif	1979	134,960	132,773	98.4
Rabi	1979/80	356,771	349,163	97.9
Kharif	1980	223,234	215,890	96.7
Rabi	1980/81	659,770	645,070	97.8
Kharif	1981	365,301	352,079	96.4
Rabi	1981/82	759,528	683,050	89.9
Kharif	1982	407,775	Not Due	---

Total loaned through Rabi 1981/82 = Rs 2,849,333,000/=

Total recovered through Rabi 1981/82 = Rs 2,710,625,000/=

Total percent recovered = 95.1

Recoveries are continuing and it is projected that a total recovery rate of 98 percent will be attained.

APPENDIX II

Outline for Credit Manual

I. Policy Statement on the Need for Agricultural Credit

II. Types of Credit

- A. Short-term
- B. Medium-term
- C. Long-term

III. Impact of Credit

- A. Production
- B. Consumptive

IV. The Role of the Cooperative Department Staff

- A. Administration
- B. Operation
- C. Statistics
- D. Supervision

V. The Role of the Cooperative Bank

- A. Administration
- B. Operation
- C. Statistics
- D. Supervision

VI. Production Credit for Members of Cooperative Societies

- A. Duties and Responsibilities of the Board of Directors
- B. Duties and Responsibilities of the Management Committee

  1. Borrower Selection

     - a. Character
     - b. Capacity
     - c. Collateral

  2. Fund Allocation
  3. Loan Packages
  4. Loan Supervision
  5. Loan Collection

C. Duties and Responsibilities of Society Management

1. Delegation of Duties
2. Loans In Kind
3. Cash Loans
4. Loan Supervision
5. Statistical Reporting

D. Society Record Keeping/Loan Documentation

1. Members Register/Shares Register
2. Cash Book
3. Loan Ledger Book
4. General Ledger
5. Loan Installments Book
6. Maximum Credit Limit Register

E. Farmer Loans

1. How to be Selected as a Borrower

   a. Loyalty to the Society
   b. Honesty
   c. Labor Availability
   d. Good Health
   e. Share Capital
   f. Marketing Agreements
   g. Qualifications for Repeat Loans

2. Introduction to Farm Management

PART IV

PAKISTAN'S
OILSEED PROCESSING SECTOR

EVALUATION OF OILSEEDS IN PAKISTAN

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The purpose of this paper is to discuss the potential of various oilseeds now grown or to be grown in Pakistan to significantly increase domestic production of vegetable oils. These oilseeds include cottonseed, rapeseed/mustard, sunflower seed, soybeans, safflower and groundnut.

Summary

- Pakistan will have to look beyond the long-established oilseed sources of cottonseed, rapeseed/mustard and groundnuts to significantly increase domestic production of vegetable oils to narrow the oil gap.

- Cotton production is not likely to expand. The world hard currency price of cotton is lower than the internal rupee price and Pakistan is subsidizing exports to gain foreign exchange.

- Rapeseed/mustard acreage has been declining more rapidly than yields have increased for many years.

- The production of cottonseed oil and rapeseed oil could be signficantly increased by utilizing solvent extraction. Kohlus and expellers process the entire rapeseed supply and expellers process more than 90 percent of the cottonseed supply due to the cost-effectiveness of these machines. The solvent plants recover more oil, but the value of the additional oil will not offset the higher cost of solvent extraction at existing oil prices.

- Pakistan must utilize oilseed crops with short growing seasons which can utilize seasonally fallow cotton, wheat and rice land.

- The most promising crops are sunflower and soybeans. Safflower looks promising from the standpoint of oil yield, but it has been grown in Pakistan for centuries and is still not an established source of oil. There are obvious harvesting problems and abandoned crops with the higher yielding spiny varieties.

- Land is available for the production of oilseeds requiring a short growing season in seasonal rotation with:

Crop	---Million--- Acres Planted	--GCP Estimate--- Percent Available	-----Million---- Acres Available
Cotton	5.0	30	1.5
Wheat	15.0	30	4.5
Rice	5.0	20	1.0
	25.0	28	7.0

- The total acreage projection by the Ghee Corporation of Pakistan (GCP) for the three crops in 1987/88 amounted to only 7.5 percent of the land estimated to be available:

	Available Acres (-000)
Sunflower	350
Soybeans	75
Safflower	200
	625

- The oilseed promotion program objectives are encouraging, but oil production targets are not likely to be achieved based on on the results for the first four years. The success of the program depends on the combined efforts of the public and private sectors.

- The currently unsatisfied and growing demand by the poultry industry for dependable supplies of quality vegetable protein meals at affordable prices may do more to stimulate the production of alternative oilseed crops in the short run than any other single factor now on the horizon.

Some examples of private sector initiatives:

1. A poultry producer contracted with farmers for 600 acres of soybeans planted in January and February, 1983, in the Punjab and is negotiating with solvent processors for tool processing to obtain meal. Oil will be produced as a result of a demand for quality protein meal.

2. A solvent processor in the Punjab may start sunflower promotion in competition with GCP.

The advantages and disadvantages of each of the oilseed crops in relation to the objective to increase vegetable oil production and to make the best use of available resources in Pakistan will be outlined.

Criteria

1. Established crop versus a new crop. A new crop requires great effort in introduction, variety selection, research, education, extension, market development, price safety net

and additional equipment for growing, harvesting or processing. With an established crop these factors are somewhat in place and simply need improvement.

2. Is it an oilseed or a protein seed? Is the value of the extractable oil more than that of the meal and vice versa? Programs to increase vegetable oilseed production involving higher oil prices would have a greater effect on production of high oil content oilseeds than on protein seeds.

3. How much oil will one acre of land produce? While there is fallow land that can be used for increased oilseed production, it may be difficult to attract enough land to sharply narrow the oil gap.

4. Is there a demand for the by-products of vegetable oil production, i.e., lint, hulls, cake or meal? Two or more products are produced when oilseeds are processed. A demand for by-products lowers the cost burden on the oil portion of the seed.

5. Does Pakistan now have efficient crushing capacity for the oilseed? How much? Any oilseed that will stimulate the utilization of unused solvent capacity for the maximum production of vegetable oil, provided solvent extraction is cost-effective, is favorable.

6. Oil quality concerns health-related issues and the amount of processing which affects the ultimate cost of the oil.

Cottonseed

In 1981/82, there were about five million acres of cotton in Pakistan. Cottonseed production was about 1.5 million tons, of which about 1.25 million tons were crushed, producing about 1 million tons of cottonseed cake and 150 thousand tons of crude cottonseed oil. Cottonseed currently accounts for about 60 percent of the vegetable oil and about 90 percent of the high protein cake and meal produced in Pakistan. This makes cottonseed, by far, the most important oilseed in Pakistan today.

The Government of Pakistan (GOP) controls the price of cotton lint and cottonseed oil. The prices of cottonseed cake and meal are not controlled by the GOP and are thus allowed to seek their own level in the market. Along with wheat, rice and sugarcane, cotton is one of Pakistan's high-priority crops, second only to wheat in acreage.

Farmers are free to sell seed cotton to cotton gins for whatever price they can receive. After ginning, the lint is sold to the GOP at a set price. The cottonseed is sold by the ginner to oilseed crushers at free market prices. The crusher sells re-

fined oil to the GOP at a fixed price of Rs 267.92 per 40 kg and is free to sell the cake and meal at whatever price he can. In March, 1983, these prices were Rs 71 per 40 kg for cake and Rs 90 per 40 kg for meal.

The GOP controls the priority farmers place on cotton acreage and crop inputs and, in turn, the production of cotton by setting the price and acquiring ownership of the lint cotton at the gin. The world hard currency price for cotton is now lower than the internal rupee price, so the GOP is subsidizing cotton exports while gaining foreign exchange in return.

The depressed world vegetable oil price is now lower than the internal oil price so the GOP also is indirectly subsidizing the cottonseed crop through oil purchases, but without benefit of the gain in foreign exchange that lint brings.

Cottonseed will likely remain the most important source of vegetable oil in Pakistan, but there is little growth potential under present conditions.

Advantages

1. Cotton is a very well-established crop in Pakistan which is not likely to decline in production in the near future. Therefore, cottonseed oil production is not likely to decline.

2. There is a well-established market for the high oil content, expeller cottonseed cake containing lint and hulls.

3. Pakistan currently uses the minimum equipment necessary to process cottonseed and has at least double the capacity required.

4. Cottonseed oil is a high-quality product that does not require a great deal of refining.

Disadvantages

1. Cotton is primarily a lint crop, secondarily a cake crop and then an oil crop. The farmer receives only about eight percent of his income from the value of the oil in seed cotton. For this reason, cottonseed oil production is very unresponsive to changes in the price of vegetable oil.

2. It takes about 40 acres of cotton to produce one ton of cottonseed. To increase cottonseed oil production in Pakistan by 200,000 tons, cotton acreage would have to increase 266 percent, from five million to 13 million acres.

3. It takes about five tons of solvent capacity to produce one ton of crude cottonseed oil. To increase cottonseed oil production by 200,000 tons would require an additional 1,000,000 tons of solvent capacity, an increase of about 400 percent.

4. It is unlikely that cottonseed will be processed in solvent plants since there is a very low demand for the low oil content cottonseed meal produced by solvent extraction. As long as cottonseed is crushed in local expellers, Pakistan will lose approximately one-third the extractable oil in cottonseed. In 1981/82, this was about 50,000 tons of oil.

The processing cost of expeller plants is less than half that of solvent plants and the difference is not overcome by increased oil production in solvent plants at current oil prices.

Cottonseed oil is largely a by-product of the production of cotton lint, and the cotton crop, like wheat, will be controlled in the national interest of Pakistan. Attempts to improve extraction of oil from existing supplies of cottonseed will not likely be cost-justified. It is felt that cottonseed oil will not play a major role in narrowing the growing oil gap in Pakistan. The GOP should view any extra cottonseed oil produced as "bonus" oil production and should look to other oilseeds to close the oil gap.

Rapeseed

In each of the last three years there has been about 1,000,000 acres of rapeseed and mustard (hereafter referred to as rapeseed) in Pakistan. This is down from the early 1970's level of about 1,300,000 acres. While acreage has been decreasing, yields have been steadily increasing from about 465 pounds per acre in the early 1970's to their present level of about 530 pounds. In 1981/82, about 241,000 tons of rapeseed were produced. From this, about 75,000 tons of rapeseed oil and 160,000 tons of rapeseed cake were produced. Rapeseed oil accounts for almost one-third the total vegetable oil production in Pakistan and about one-seventh that of cake and meal. Rapeseed is the second most important oilseed in Pakistan today.

The GOP is not involved in the production, marketing or pricing of rapeseed or its products. Farmers are free to sell rapeseed to anybody at any price, and they sell primarily to local kohlus and expellers. In early 1983, the price of rapeseed was about Rs 120 per 40 kg. The kohlus and expellers are also free to sell rapeseed oil and cake to anybody at any price. Some sell oil and meal to wholesalers who, in turn, sell to retailers.

In early 1983, the crushers were receiving about Rs 320 per 40 kg for oil and about Rs 55 per 40 kg for cake. Some kohlus and expellers sell oil and cake directly to the consumer. The cake

sells for about Rs 60 per 40 kg. There was a wide range of price quotations for oil sold in this manner--from Rs 320 to Rs 560 per 40 kgs. To compete with other oil products, rapeseed oil is probably selling in the Rs 450 to Rs 550 per 40 kg range.

Crude rapeseed oil has a strong flavor for which people are willing to pay a premium. The cake is used as livestock feed and some is de-oiled by the solvent industry--about 38,000 tons for each of the last three years. A small quantity of meal produced by de-oiling is used by the poultry industry, while the rest is exported.

Advantages

1. Rapeseed is an established crop.

2. It is an "oil" crop with about 75 percent of its value coming from the oil.

3. There is an established market for the cake, although it does sell at much lower prices than cottonseed cake.

4. Equipment currently exists in Pakistan to crush rapeseed.

5. Rapeseed does not require much solvent capacity to produce 1 ton of oil--about 2.5 tons of pre-press capacity and about 1.7 tons of solvent capacity.

Disadvantages

1. Rapeseed only produces about 160 pounds of oil per acre due to its low yields and the fact it is crushed by kohlus and expellers.

2. While there is a market for the cake, there is only a small market for the meal produced by the solvent industry and the demand is not expected to increase.

3. Almost all rapeseed is being crushed by expellers and kohlus, and only about 80 percent of the extractable oil is being recovered. There is every indication that rapeseed will continue to be crushed in this cost-effective manner, resulting in the loss of 15,000 to 20,000 tons of oil annually.

4. Because of the erucic acid content, rapeseed oil is considered a health hazard in other parts of the world.

Rapeseed oil production can be increased by increasing either crop production or the amount of oil extracted. To increase crop production, the GOP could provide farmers with the new Canola (oil which contains no erucic acid) varieties of rapeseed, provide fertilizer and other inputs or establish some type of deficiency payment or price floor for rapeseed. To increase the amount of oil extracted, rapeseed could be processed by pre-press solvent plants rather than kohlus and expellers.

It is felt that providing farmers with the new Canola variety is the only promising option. This should increase rapeseed oil production and provide a better quality oil for human health and an improved source of protein meal. Rapeseed is here to stay. The oil is a preferred product and will be in greater demand than the cake.

The crop receives very little GOP attention and operates in a free market. This is good. However, effort should be made to increase the yield of rapeseed oil per acre. Because of the lack of a market for rapeseed meal, it is highly unlikely that rapeseed will be processed in solvent plants, so Pakistan will continue to lose about 20 percent of potential rapeseed oil production. If rapeseed yields are increased with the new Canola varieties, rapeseed oil production could probably increase and eventually surpass cottonseed oil production. While its production may increase in the future it is felt that rapeseed will not be one of the oilseeds which will significantly narrow the oil gap.

Groundnuts

The acreage of groundnut has been up and down since 1973, and yields have actually declined since the early 1970's (average 1,445 kg/ha), compared with the past three years (average 1,229 kg/ha).

According to the Foreign Agriculture Service (FAS), about 60 percent of this small crop has been processed for oil and meal during the past ten years and none is reported as consumed for food use. This is contrary to discussions in Pakistan during which it was reported that most of the crop is consumed directly as food. It is reliably reported that some groundnuts are crushed in the home with stones to produce enough oil for very special Pakistani dishes.

The crop is grown in Sind, Punjab and Northwest Frontier (NWFP) Provinces. In NWFP is it intercropped with wheat.

Groundnut is a free market commodity and is frequently contracted with shellers who pack the shelled nuts for the retail trade.

Advantages

1. Groundnut is an established crop.

2. It is an oilseed crop and the meal is of high quality.

3. The oil commands a premium price.

Pre-press solvent capacity is available to extract the oil from the shelled nut.

Disadvantages

1. Groundnut has a poor-quality planting seed and no research is being done to improve it.

2. Harvesting problems. No suitable harvesting machines have been developed and hoes are used to unearth the nuts.

3. The crop is plagued by rodents, both in storage and in the fields.

4. No suitable decorticating equipment has been developed for it.

5. The presence of aflatoxin is a severe drawback to the use of groundnut as human food, as well as an animal feed.

Pakistan will have to look to other oilseeds to close the oil gap.

Sunflower

It is hard to estimate the sunflower acreage and production in Pakistan. The GCP is promoting sunflower production and says 44,000 acres were planted with 36,000 acres harvested in 1981/82. This amounts to about a 20 percent abandonment of planted acreage which is attributed to hail and other problems. From this 36,000 acres, GCP procured 6,500 tons. Another 25 percent was added for the sunflower GCP did not procure and roughly 8,100 tons was calculated for 1981/82 production. It is felt this is the best reasonable estimate available for 1981/82 production.

Yields for 1981/82 were about 500 pounds per acre if 36,000 acres were actually harvested. If less acreage were harvested, yields would be higher. Actual yields are important because sunflowers

could become an important source of oil for Pakistan if commercial production were to become profitable. Average yields would have to be higher than 500 pounds per acre if sunflower is to be a successful oilseed crop.

The GCP has decided that sunflower is an oilseed crop that will help narrow the oil gap in Pakistan. Since 1978, it has been promoting the crop by providing farmers with seed and technical information and purchasing the crop at the farm gate, thus saving the farmer transportation and octroi[1] charges. This program has been at least partly successful since production has increased from about 200 tons before the beginning of the program in 1978 to its current level of about 8,100 tons. GCP is importing two hybrid varieties of sunflower--one from the U.S. and one from Australia. While GCP's extension program shows some production increase, there are real problems with the procurement program. About 25 percent of the crop was not procured by GCP. This estimate came from GCP and was supported by the observations of a member of a donor oilseed project.

The sunflower procurement price for 1982/83 has been set by GCP at Rs 140 per kg. After GCP collects the seed, it contracts with a solvent plant to crush for oil and meal. Most of the 1981/82 crop was crushed by Solvex in Multan at Rs 15 per 40 kg. The agreement with Solvex called for GCP to receive 350 kg of oil, 420 kg of meal and 190 kg of hulls for every 1,000 kg of seed crushed. Experience elsewhere indicates Solvex should have produced about 400 kg of oil per ton of seed crushed. Had GCP taken 350 kg per ton, it would have left Solvex with 50 kg of oil per ton.

In terms of oil shortage, this situation is not really a problem since the oil was produced and consumed in Pakistan. It is another indication, however, that oil does slip past GCP. The 450 kg of meal per ton of seed GCP required in its agreement with Solvex does pose a problem for Pakistan's oil, low-fiber (10 percent) meal containing 44 percent protein. If lysine is added to this meal, it is an excellent source of vegetable protein in poultry rations. Unfortunately, a ton of sunflower contains only about 300 kg of this quality low-fiber meal, not 420 as specified by GCP. What GCP received was meal with 35 percent protein and about 15 percent fiber. While this meal is not as good as it could be, it is the best vegetable protein currently produced in Pakistan and used in poultry rations.[2]

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[1]A toll charge on products when they move into the village or community where they will be sold or processed.

[2]In all fairness to Solvex, it was living up to the agreement with GCP when it produced this meal which contains 300 kg of meal and 120 kg of hulls. The company does not have the proper equipment to properly de-hull the sunflower seed.

This sunflower meal is selling only for about the same price as cottonseed meal due to its high fiber and low protein content. With lower fiber and more protein, it should sell for a much higher price in Pakistan. As the price of quality sunflower meal increases, the price of sunflower seed can also increase. The low price of sunflower meal is keeping down the price of sunflower seed which, in turn, is discouraging sunflower production. If the quality improves and the price of the meal increases, sunflower production should also increase.

Advantages

1. Sunflower seed is primarily an "oil" crop since about two-thirds of its value comes from oil.

2. It has the potential to produce the highest oil yield per acre in Pakistan. With current sunflower yields of about 500 pounds per acre, sunflower produces about 200 pounds of oil per acre. If sunflower yields increase to 800 pounds per acre (about two-thirds of current U.S. yields), sunflower would produce 320 pounds of oil per acre.

3. If sunflower meal is properly processed, it has a ready market in the poultry feed industry.

4. Sunflower requires the least solvent capacity per ton of oil extracted of any major oilseed or potential oilseed. To produce one ton of oil requires 1.8 tons of pre-press capacity and one ton of solvent capacity.

5. Sunflower will most likely be crushed by solvent plants due to the potential demand for the meal produced by solvent extraction and the lack of a demand for the cake from expellers. This means that Pakistan should benefit from all the extractable oil in sunflower.

6. Sunflower oil is of a very high quality requiring little refining.

Disadvantages

1. Sunflower is a new crop which must be introduced.

2. Pakistan does not have the de-hulling equipment to produce a low-fiber, high-protein meal.

3. There may be six million acres of fallow land on which sunflower can be grown. However, this acreage can only support 1.5 million acres of sunflower in any given year if farmers in Paksitan adopt a rotation system similar to the

ones adopted by farmers in other countries. Farmers in the U.S. currently grow sunflower in only one out of every four years on the same land.

4. While the sunflower meal produced by Solvex is the best source of vegetable protein in Pakistan today, the high fiber content and the mold reported in some samples have given this lot of meal a bad reputation in the poultry industry.

The rapidly growing poultry industry's demand for quality protein--supplied most efficiently by solvent extraction--may create more oil in the near term than any other single factor.

The GCP has an ambitious program to increase acreage of sunflowers from perhaps 44,000 acres in 1981/82 with yields of less than 500 pounds/acre; to 100,000 acres in 1983/84 with a yield of 740 pounds/acre; and to 250,000 acres in 1987/88 with a yield of 905 pounds/acre.

Sunflower production should be encouraged because the crop offers the greatest potential for increased vegetable oil production in Pakistan. The present GCP promotion program could be streamlined and made more effective and the private sector should be encouraged to play a more prominent role in producing, processing and marketing sunflowers.

Soybeans

It was very difficult to estimate the acreage and production of soybeans for the 1981/82 crop. It is known that some were grown in the Punjab and in the Swat Valley of NWFP. Estimates were heard to be as high as 8,000 acres. GCP reports purchases of only 713 tons, which is probably much less than the actual production figure as is the situation with sunflower.

There are reports of small, experimental plots yielding as much as 1.5 tons per acre in Swat. This is roughly twice the average farm yield in the U.S. The average farm yield in Pakistan was probably less than 500 pounds per acre. This was the reported yield for the 1978/79 crop.

The GCP is also promoting soybeans as a potential source of additional oil, but with much less effort than with sunflower due to the relatively low oil content of soybeans. GCP has imported some U.S. varieties and is trying to determine which will perform best in Pakistan. *Williams* appears to be the most popular at this time. While first-year results for most varieties were very encouraging, some difficulty was encountered during the second year. Seed stored in the extremely high temperatures of Sind and Punjab had very low germination rates the second year. In

addition, reports were heard of problems with the inoculant, which has been an additional drawback.

Advantages

1. Soybeans have a short growing season and can utilize land now fallow between the planting of wheat and that of cotton.

2. Soybeans tend to loosen the soil and yield improvements have been reported in crops following soybeans.

3. Soybeans are recognized primarily as a quality protein crop; however, the oil yield per acre is over 129 kg, compared with about 57 kg/acre for cotton in the U.S.

4. There is a ready market for the meal in the growing poultry feed industry. Five thousand tons were imported recently from the U.S. for about $400 per ton, and there is additional interest at $330 per ton CIF Karachi duties paid.

5. Soybeans can be processed at existing expeller and solvent plants.

6. Soybean oil is of good quality, and domestic refiners are familiar with the imported products.

Disadvantages

1. The soybean crop must be introduced.

2. Pakistan does not have de-hulling equipment to produce a high-protein, low-fiber soybean meal that would greatly increase feed efficiencies in the poultry industry.

3. Soybeans may be processed at expeller plants for the cake and contribute very little toward filling the oil gap.

4. Planting seed germination will be a problem in the high temperature areas of Punjab and Sind. Planting seed might have to be produced and held in the cooler NWFP.

Understandably, GCP has a less ambitious program for soybeans than for sunflowers or safflowers because soy is not primarily an oil crop. The GCP program goes from 8,000 acres in 1982/83 with yields of probably less than 500 pounds/acre; to 25,000 acres in 1983/84 with yields of 735 pounds/acre (12.25 bushels); and to 75,000 acres in 1983/84 with yields of 943 pounds/acre (15.72 bushels). The yields per acre apparently are based on minimum inputs. The crop may not be profitable at these low yields.

Soybean cultivation should be encouraged because the crop may profitably utilize land that is fallow during a short growing season and add oil to fill the gap. Soybeans may be rotated with sunflowers and other crops with a possible beneficial effect on the succeeding crop.

Pakistan will have to depend on any new oilseed crop that can be grown on seasonally fallow land to help fill the oil gap.

Safflower

It is hard to estimate safflower acreage and production in Pakistan. The GCP purchased 1,307 tons of seed in 1981/82, but it is not known how many acres this represents.

The GCP is promoting safflower as an oilseed crop that will help narrow the oil gap, and the promotion program is similar to that of the sunflower program.

The GCP program appears very optimistic based on 1981/82 performance:

	1981/82	1982/83	1986/87
Target acres	40,000	60,000	150,000
Planted acres	22,000	?	?
Production (tons)	?	13,333	39,990
Yield/acre Number Targeted	?	490	588
Procured (tons)	1,307	?	?
Support Price (Rs)	120/40 kg		

Advantages

1. Safflower is an oilseed crop since most of the value of the crop is derived from oil.

2. The oil is of high quality.

Disadvantages

1. Although safflower has been grown in this part of the world for centuries, it still must be described as a new crop that must be introduced.

2. Spiny varieties are very difficult to harvest. Spineless varieties have lower yields and lower oil content.

3. At least a 120-day growing season is required which restricts planting between some summer crops.

4. Meal is of low quality.

Solvent	Not Decorticated	Decorticated
Protein (%)	22	42
Fiber (%)	37	15

The GCP should support safflower cultivation because it is a high oil content crop and several crops will be required to help close the oil gap.

The Oilseed Promotion Program

There is little encouragement from the outlook for increased vegetable oil production from the traditional oilseed sources--cottonseed, rapeseed and groundnut. Pakistan must depend on the production of new oilseed crops to prevent the oil gap from growing. The success of these new oilseed crops--sunflower, soybean and safflower--is in the national interest and will depend in large measure on the effectiveness of a program to promote increased production. Promotion of these new oilseed crops was started in 1978 with the GCP in charge. Four years after the program was started, the results reported are as follows:

Year	Crop	Target (Acres)	Area Sown (Acres)	Achievement (%)	Tons*	Lb./Acre Sown*
1981/	Sunflower	45,000	44,200	98.2	6,473	323
1982	Soybean	15,000	8,000	53.3	713	197
	Safflower	40,000	22,000	55.0	1,307	131
TOTAL		100,000	74,200	74.2	8,493	252 (Average)

*Procurement by GCP.

It is known that all the oilseeds produced were not purchased. Some were retained for seed and even some sunflower seed was crushed at kohlus. Some seed was never collected from farmers participating in the program.

Expressing the quantity of seed purchased in terms of potential oil, utilizing the most efficient solvent extraction method:

	Tons	Crude Oil Yield (%)	Oil Tons
Sunflower	6,473	40.1	2,596
Soybeans	713	18.3	130
Safflower	1,307	36.9	482
	8,493	37.8	3,208

(The actual oil recovery was less because some of the seed was crushed by expellers.)

Production Constraints as Listed by GCP

1. Seed Quality. High-yielding varieties adapted to local conditions are not available. Sunflower and soybean planting seed stored during the summer months in high temperatures germinate poorly. Spineless varieties of safflower are low yielding, of low oil content and require a longer growing season.

2. Utilization of By-Products. Sunflower and safflower meal are not accepted. Cake disposal becomes a problem if the seeds are processed by expellers.

3. Threshing. Farmers have abandoned fields of spiny variety safflower due to harvesting difficulty, even though the yield was higher.

4. Unsuitable Seeding Equipment. Seed bed preparation is not adequate and seed depth is uneven.

5. Bird Damage. Sunflower seeds are relished by parrots.

These are serious problems that must be overcome and have been dealt with in other countries with some success. For example, India addressed the germination problem by providing air-conditioned storage for seed beans during summer months.

There is a demand by Pakistan's growing poultry industry for improved sources of vegetable protein meal. If properly processed, sunflower and soybean meal will command a premium over expeller cake for poultry feed.

The financial justification for the oilseeds program is apparently based on import substitution. During the five-year period, the GCP projects a total of 170,580 tons of oil will be produced as a result of the program and will replace oil imports costing Rs 6,700/ton:

170,580 tons x Rs 6,700/ton = Rs 1,142,886,000 or $91,430,880, compared with a cost of about $75 million.

Import Substitution
(1,000 tons of oil)

Year	Sunflower	Safflower	Soybeans	Total
1983/84	11.76	4.26	1.33	17.35
1984/85	15.51	6.21	2.01	23.73
1985/86	19.59	8.41	2.76	30.76
1986/87	27.43	10.80	3.88	42.11
1987/88	35.92	15.58	5.13	56.63
	110.21	45.26	15.11	170.58

If the objectives to produce oil are met, the following quantities of meal will be produced:

	1,000 tons of meal			
Year	Sunflower	Safflower	Soybeans	Total
1983/84	14.11	6.58	6.16	26.85
1984/85	18.62	9.92	8.97	37.51
1985/86	23.51	13.60	12.15	49.26
1986/87	32.92	19.16	15.60	67.68
1987/88	43.11	23.35	22.51	90.97
	132.27	74.62	65.39	272.28

The oilseed promotion program should have more private sector involvement. There is apparently some private sector involvement in seed breeding, but no input by the mixed feed industry or by the oilseed processing industry--the two with the most to gain if the program is to succeed--could be found. The solvent extraction plants are operating at less than half their capacity in Pakistan and at least one is dormant. It would seem that some of these plants would welcome the opportunity to participate in programs to increase the utilization of unused capacity.

If a safety net price for oil were established by GCP and the processor were free to sell the oil and the meal on the open market, he would have a strong financial incentive to promote the crop and to perform the milling function in the most efficient

manner. Also, the GOP would solve some of the procurement, transportation and payment problems by going through the established marketing system to get the oilseed to the processing plant. There could be substantial savings in time and the more effective use of money by cooperating with the private sector.

THE ORGANIZATION OF THE OILSEED COMPLEX IN PAKISTAN

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The term "oilseed complex" refers to those institutions involved in the production, processing and distribution of oilseeds and their products. The focus of this paper will be on the overall market structure, and more specifically, how each component of the oilseed complex is related to others.

A schematic of the oilseed complex is attached to illustrate the relationships between the various sectors. The schematic can be viewed in three segments. The upper portion represents the major sources for oilseeds and their products, importers and Pakistani farmers. The middle portion represents the processing sector--crushers, refiners and feed mills. The bottom portion represents the destinations of major products resulting in part from oilseed inputs. In the domestic market these products are edible oil, meat and soap, and for the export market they are de-oiled rice bran and de-oiled rapeseed meal.

The remainder of the paper discusses the sources, processing and final products of oilseeds in Pakistan. Each section will (1) briefly describe a sector, (2) discuss its relationship to the other sectors and the relationships which exist within the sector and (3) highlight any significant or outstanding aspects of the sector or its components.

Source

Pakistan's two sources for oilseeds and oilseed products are Pakistani farmers and importers. Pakistani farmers produce almost all of the high-protein cake and meal which is available in Pakistan while importers account for the bulk of the oil available.

The major oilseeds available domestically are cottonseed and mustard/rapeseed (hereafter referred to as rapeseed). Both crops are produced in all four provinces with the Punjab being the largest producing province, accounting for about two-thirds of total cottonseed and rapeseed production, followed by Sind which produces about one-third. Baluchistan and NWFP each contribute about one percent. Other oilseed crops--in order of the quantity produced--are groundnut, sesamum, sunflower, safflower and soybeans. Some coconut is also produced in Lower Sind and Baluchistan. The total production of all of these additional oilseeds amounts to only about five percent of the combined cottonseed and rapeseed production. In addition, at least two of these oilseeds--groundnut and coconut--are primarily consumed whole and are not crushed for their oil and meal.

GCP has been promoting sunflower, safflower and soybeans since about 1978. While it is difficult to determine exactly how effective the GCP program has been, it is obvious there have been increases in the production of these three crops. GCP apparently intends to continue promoting these crops, especially sunflower.

Soybeans will also be produced. With respect to domestic production, cottonseed and rapeseed are about the only oilseeds today and while other oilseeds look promising, they still have a long way to go before they will be able to substitute for a significant proportion of the rapidly growing vegetable oil imports.

Most of the vegetable oil consumed in Pakistan is imported. The imports are almost equally split between soybean oil (primarily from the U.S.) and palm oil (primarily from Malaysia); a small amount--less than five percent of total imports of the other oils--was also imported. The Trading Corporation of Pakistan (TCP) imported 450,000 of 625,000 tons of vegetable oil in 1981-82.

As world oil prices declined over the last few years, the private sector has accounted for an increasing share of total vegetable oil imports. Since the private sector can currently import palm oil for about Rs 4.5 per kg and soybean oil for about Rs 5.5 per kg with the current wholesale price in Karachi at about Rs 7.5 per kg, the private sector will probably continue to increase its share of total vegetable oil imports. Private importers are free to buy from any international source and sell to any private domestic party.

TCP also imports oil at these low prices and resells to GCP for Rs 6.7 per kg. TCP imports only for GCP which purchases nearly all its imported oil from TCP, except during infrequent periods of shortage when it is forced to buy oil from private importers. TCP is the largest importer of vegetable oil; although the private importers have been increasing their share in recent years, TCP will remain the major importer.

Because of depressed world vegetable oil prices, both TCP and private importers are making very large profits by importing oil at prevailing world prices and reselling at the higher domestic price; however, this will likely change when world vegetable oil prices recover. When the world price was above the domestic price, TCP absorbed the loss from reselling to GCP at a lower fixed price. Losses or gains are simply shifted from one GOP account to another.

It is understood that the GOP has recently (within the last year or two) exempted palm oil imports from its 70 percent import duty and 10 percent sales tax. It now enters the country "free" except for a five percent surchange, as does soybean oil. Only "recognized industries" are allowed to import palm oil on this basis; however, refiners are considered to be a "recognized industry." Virtually all palm oil entering Pakistan now is coming in duty free from Malaysia.

Processing

The three main sectors of processing will be focussed upon: extraction, refining and feed milling.

Extraction

Extraction is represented by the crusher and de-oiling boxes on the flow chart. There are three methods of oil extraction being used in Pakistan today. These are kohlus, expellers and the more modern solvent plants.

Kohlus are large mortar and pestle type operations powered by either animals or electricity. Kohlus operate almost exclusively on rapeseed, although other oilseeds may occasionally be crushed. The kohlus recovered about 75 percent of the extractable oil in rapeseed.

Expellers are usually low pressure, mechanical screw presses currently used primarily to crush cottonseed. Expellers extract about 12 percent crude oil (about 70 percent of the extractable oil) and 82-85 percent high-oil cake. A few expeller plants are equipped to do some conditioning of the seed prior to expelling while perhaps 95 percent are not. Few expeller plants delint or dehull. Considering the lack of preparation of the oilseed, these units are amazingly efficient, although they do leave a considerable amount of oil in the cake--eight percent or more.

If all cottonseed and rapeseed currently crushed by kohlus and expellers were processed by solvent operations, Pakistan could increase vegetable oil production by about 70,000 tons annually. The solvent plants in Pakistan are reasonably modern. Hexane is used to separate the oil from the meal. There are about a dozen solvent plants, each with a daily capacity of 50 to 100 tons, remaining out of the 15 or 16 constructed during the 1960's. These were constructed prior to nationalization in 1972 when the outlook was much brighter for sizeable investments in the solvent industry. These plants leave only 1.5 percent of the oil in the meal compared to the expellers which leave eight percent, and the kohlus which leave 13 percent oil in the cake.

The solvent industry is currently operating in limited quantities of cottonseed, rapeseed cake and rice bran. The solvent plants located in Hyderabad and Karachi are de-oiling rice bran and rapeseed cake. The oil is used for soapstock and the meal is exported. Up-country plants operate intermittently when they are able to sell meal to the poultry industry.

Refining/Blending

The refining industry is largely dominated by GCP, although private refiners have recently increased their role. The term

"refining" is used here to include hydrogenation, bleaching, deodorizing and canning. The refining sector acquires oil either from importers--whether TCP or private--or from crushers. The products of refining--vanaspati and cooking oil--then go through the marketing chain to the final consumers.

Although most vegetable oil--primarily cottonseed, soybean and palm oil--passes through refiners before going to the consumer, some oil bypasses the refiner and goes unrefined directly from the importers and crushers to the consumer. Practically all rapeseed oil goes directly to consumers as crude oil. As much as 20 percent of the cottonseed oil is sold directly to the consumer, even though all cottonseed oil is supposed to be sold to GCP at a lower fixed price for vanaspati production. This oil may or may not go to the refiner before going to the consumer.

Feed Milling

The other major link between the crushing sector and the final consumer is the animal feeds sector which is represented by the livestock and poultry boxes in the schematic. The livestock sector consumes the bulk of the oilseed cake. The feed mill sector is devoted exclusively to poultry since there is no organized sector mixing feed for other classes of livestock. Livestock is the largest consumer of oilseed products. In 1981/82, livestock consumed approximately 1,500,000 tons of cake and poultry about 50,000 tons of rapeseed and cottonseed meal. This is almost double the 800,000 tons of oil consumed by humans.

These three processing sectors play a critical role in the oilseed complex since they link the primary input (oilseeds) to the final products (vegetable oil and high-protein meal). Because of the joint product nature of the oilseed complex, it is not possible to alter one product without affecting the nature or price of the other. Therefore, any policies designed to increase vegetable oil production will have an influence on the cake/meal market and, in turn, will have an effect on livestock and poultry production in Pakistan. Likewise, any changes in livestock and poultry production will affect vegetable oil production.

Final Products

Final oilseed products can be placed in four categories, with the two major categories being edible oils and meals and the two minor categories being soap and exported meal.

The edible oils category consists of vanaspati, cooking oil and desi ghee. While livestock and poultry feeds are the largest category based on volume, edible oils are the largest category based on value.

Vanaspati, which means vegetable product, is usually a blend of hydrogenated soybean and cottonseed oil and crude palm oil. It is similar to shortening in that it is solid or semi-solid at room temperature. Vanaspati is produced primarily by GCP or GCP-licensed refineries and currently carries a 12.5 percent excise tax. Another vegetable oil product is "palm oil vanaspati." Other than the lack of an excise tax, the distinction between palm oil vanaspati and true vanaspati is not clear. This product is either pure crude palm oil or crude palm oil mixed with a small amount of another oil. It is solid at room temperature and has a consistency very similar to vanaspati. It is often represented to the consumer as vanaspati and can be considered an almost perfect substitute for vanaspati at the retail level.*

Cooking oils are liquid at room temperature and usually contain only one type of refined oil, with soybean and sunflower seed oils being the most common.

Two final oil products are ghee, which means butter product, and butter. Ghee is a clarified butter product and was the primary frying medium in the early 1970's. At that time, ghee was selling for about twice the price of vanaspati. Today, vanaspati has replaced ghee as the primary frying medium as a result of the low supply and high price of ghee. At the retail level, vanaspati and cooking oil is sold either in pre-packaged, brand-labeled tins (2.5, 5 and 16 kg) or in bulk from open tins and drums.

Some rapeseed cake and rice bran are de-oiled by the solvent industry. The oil extracted from the rapeseed cake and rice bran is an inedible oil. Most of the oil is used to make soap; however, some is mixed with edible oil and sold as such. The resulting meal is exported to Europe since there is little demand for these products in Pakistan.

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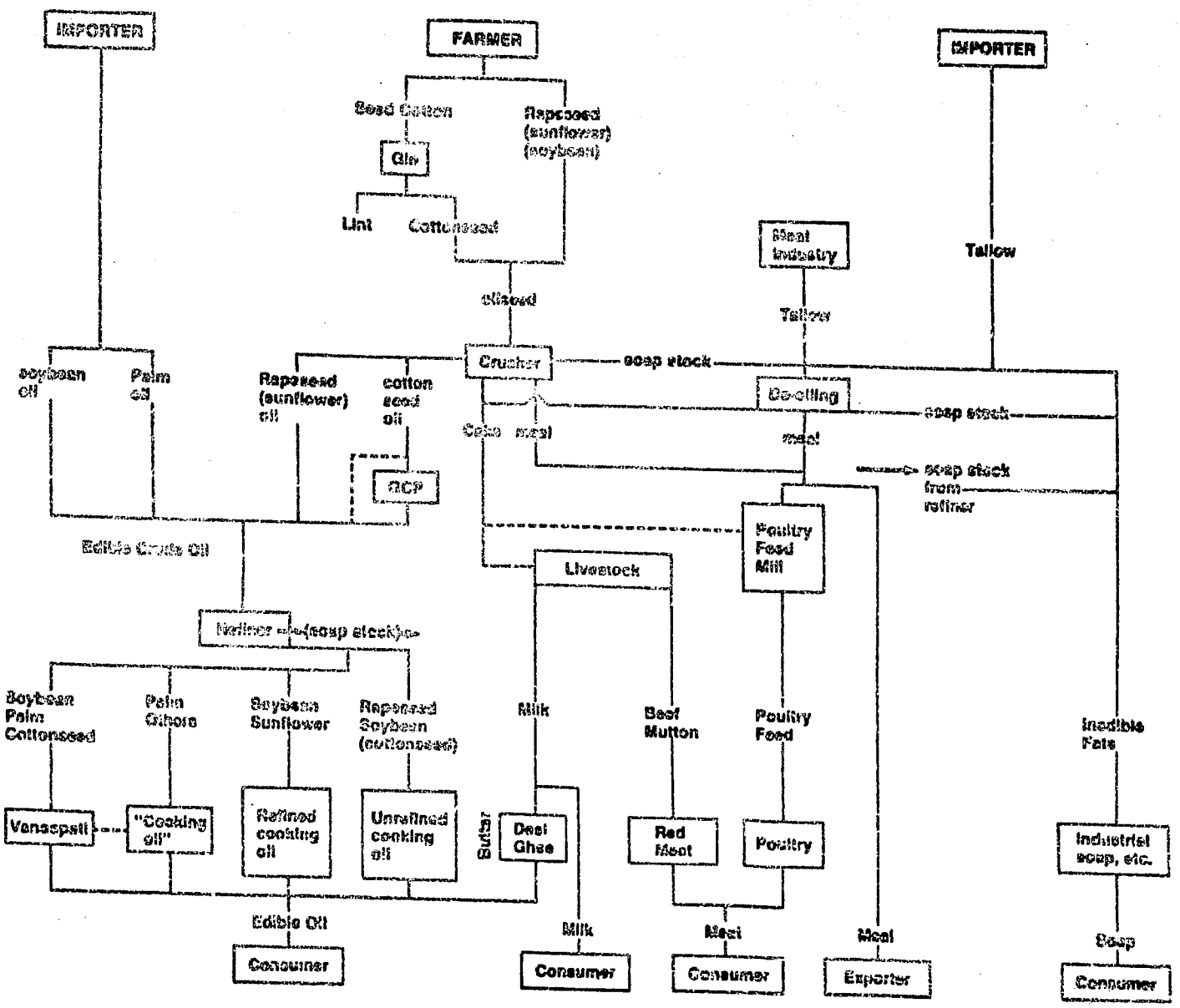
*The term "perfect substitute" is used here to indicate the degree to which the two products are interchangeable at the retail level and does not in any way refer to the quality of either product.

Organization Chart of the Oilseed Complex



OILSEED PROCESSING IN PAKISTAN

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March, 1983

I. Summary and Recommendations

Assuming the plants visited are representative of the entire oilseed processing industry in Pakistan, only 35 to 40 percent of available capacity is now being utilized. Both the Lahore expeller plants and solvent extraction plants are being operated about the same percent total capacity. The solvent extraction plants visited process only rice bran and rapeseed expeller cake, not oilseeds.

Unfortunately, it appears that an area that needs more edible oils has most of the oilseeds processed in inefficient kohlus and Lahore expellers with no advance preparation. As a result, the oil yield is at best only about 70 percent of that obtainable from solvent extraction plants with preparation machinery from the same amount of seed.

In addition, the resulting cake from the expellers and kohlus is not as nutritious a feed ingredient as the low-oil, high-protein meal would be. The animal feeders, other than poultry feeders, believe the high-oil cake loaded with lint and hulls is better for their livestock. They should, in some manner, be shown in a convincing way the fallacy of their present belief.

It is doubtful that many changes can be instituted for any marked improvement in the near future. To divert the processing from the many small kohlu and expeller plants to a few larger, more efficient solvent extraction plants would have the devastating economic effect of closing hundreds of small plants. The one exception would be improvement in seed storage practices, especially those observed for cottonseed.

As shown in Table 1, the percent of free fatty acid (FFA) in the seed samples were, for the most part, quite high, ranging from two percent to 7.6 percent. Seed properly stored and handled normally would have less than 1.5 percent FFA. Normal refining losses in the oil vary in proportion to the FFA content. The expected losses from good cottonseed and from each sample analyzed would be:

Table 1
Comparison of Free Fatty Acids, Refining Losses and Kg Refined Oil Per 100 Kg Crude Oil

Plant	Percent FFA	Expected Refining Loss	Kg Refined Oil/ 100 Kg Crude
(Good Seed)	-1.5	-2.0	+98.0
Ell Adahia	4.0	5.0	95.0
Farooq	7.58	9.3	90.7
Gizri	3.95	5.0	95.9
A. Khan	1.96	2.5	97.5

From three to seven kg more refined oil would have been available per 100 kg crude oil produced had the seed been properly stored and handled before processing in the plants visited. It would not require much investment to properly pile the cottonseed outside to prevent the excessive FFA development. It would also be necessary to keep the bagged cottonseed from the gins to the expeller plants dry until it is processed by storing the bags under cover.

As explained in Section III, there does not seem to be any justifiable way to divert oilseed processing from inefficient expeller plants to solvent extraction plants. Oilseed production would have to be more than doubled to reach the present processing capacity and more expeller plants would have to be built before that production were reached.

II. How the Study was Conducted

Over a ten-day period, 8 March through 17 March, 1983, oilseed processing plants in Karachi, Hyderabad, Sukkur and Lahore were visited. In total, 14 plants were visited, including five solvent extraction plants (one with high pressure, pre-presses), five Lahore low-pressure expeller plants, one plant with large high pressure presses and three kohlu plants--two of which were not operating. At each plant, as much information as possible regarding capacity, efficiency and cost was obtained from knowledgeable people. Also while traveling between plants, observations of cottonseed storage methods at the gins were noted.

A. Major Findings from Each Plant Visited

Solvent Extract Plants (see Table 2)

1. Taj Solvent Extraction Plant--Karachi. Lurgi extraction equipment capable of 100 MTPD, clean and very well maintained. The plant has very little preparation equipment, consisting only of a small screen to remove FM, a conditioner to heat rice bran to 75 degrees C, and a pellet mill. All appeared to be in fair condition, but the area was very dirty. The plant processes rice bran or rape cake. The rice bran contains 10 to 12 percent oil, and the rape cake 7 to 8 percent oil, but both are solvent extracted to produce meal at 0.5 percent residual oil with a solvent loss of about 0.5 percent. The plant operates about eight months per year with five operators per shift for boiler, preparation and extraction areas. The plant could be upgraded

for oilseed processing with the addition of preparation equipment. No cost figures were available.

Table 2

Comparison of Solvent Extraction Plants Visited
(Basis: Data Given at Plant)

	Date of Visit				
	8 March	9 March	12 March	13 March	17 March
Plant	Taj	Bengali	Burarji	Indus	Kohinoor
MTPD Capacity	100	75	50	100	150
Months/Year Run	8	3	6	8	0
Percent Capacity Utilized	67	25	50	67	0
Materials Processed	Rice Bran or Rape Cake	Rape Cake	Rice Bran	Rice Bran	-
% Oil in Material:					
Rice	12				
Rape	8	6	-	12.5	-
% Oil in Meal	0.5	0.5-1.0	1.0	1.0	-
% Solvent Loss	0.5	1.2	0.12	0.8	-
% Total Capacity Utilized = 37.5					

2. Bengali Solvent Plant--Karachi. Krupp extraction equipment with a Blaw-Knox design extractor for 75 MTPD, very clean and well maintained. The plant has the most complete preparation area observed, consisting of cleaners for all types of oilseeds; delinters, dehullers, crushing rolls and conditioners for cottonseed; decorticators and 10 Krupp high pressure, prepresses, each with a cooker for sunflower and safflower; and cracking rolls, conditioner and flaking rolls for soybean. All the preparation equipment has been monthballed but appears to be in excellent condition, ready for use when feasible.

The plant has processed cottonseed, groundnuts, copra, rapeseed and sunflower in the past but is presently operating on purchased rapeseed cake 90 to 110 days per year, as cake is available. The cake received contains six percent oil extracted to 0.5 to 1 percent oil in

meal, with 1.2 percent solvent loss. All the cake is purchased from local expeller mills. Ninety percent of the extracted meal is exported. All the oil is sold in Pakistan. No cost figures were available.

3. Burarji Ardshincousji--Kotri. Lurgi extraction equipment using Schneckens to de-solventize and no mineral oil solvent recovery system for 50 MTPD, clean and fairly well maintained. The plant has very little preparation equipment, consisting of a screen, conditioner and pellet mill. It processes rice bran only five to six months per year, with 1 percent oil left in the meal and a 4.5 gallon solvent loss per ton (0.12 percent). No cost figures were availble. The plant needs preparation equipment to process oilseeds efficiently.

4. Indus Cake and Oil Producers--Nawabshah. French extraction equipment for 100 MTPD, clean and fairly well maintained. The plant has preparation equipment for cottonseed, consisting of cleaner, delinters, dehullers, conditioner and flaking roll, but processes only rice bran, as available, about eight months per year. It has a conditioner and pellet mill for rice bran preparation. The purchased bran is 12.5 percent oil, and the extracted meal has 1.0 percent oil, with 0.8 percent solvent loss. To reduce the extremely high solvent loss, the plant should cut nine inches off the plug feed conveyor and purchase D-T gate arm and pump seals.

5. Kohinoor Oil Mills, Ltd.--Lahore. De Smet extraction equipment for 150 MTPD. The plant has preparation equipment consisting of delinters, dehullers, crushing rolls, two Rosedown high-pressure expellers for prepressing, a flaking roll and a cake breaker. In addition, it has 20 Lahore six-inch low-pressure presses. The plant has been idle for the past three years, having previously run cottonseed and groundnuts.

Lahore Low-Pressure Expeller Plants

1. Ell Adahia Oil Mill--Usanabad. Three Lahore six-inch presses, two operating, processing seven MTPD of whole cottonseed. The plant operates three to four months per year. There is no preparation equipment. The whole cottonseed has 16 percent oil, consisting of a blend of 25 percent NTS seed and 75 percent NTR seed. Plant officials said they could not process NTS alone, thus the blending. Cake is produced with four to five

percent residual oil. Crude oil recovered equals 11 percent of the seed processed. After caustic refining, it yields eight percent to the GCP due to excessive refining loss.

Soap stock is sold on the open market and all the cake is sold domestically. All cottonseed is received in bags and all the cake is bagged for sale. The entire mill is run from a line shaft driven by a 75 HP motor. Two expellers were running during the visit and the motor was only pulling 20 to 22 amps--practically no load. There are nine men per shift running the plant. The processing costs are Rs 325 per MT. Samples of seed and cake were obtained for analysis.

2. Farooq Oil Mills--Hyderabad. Twelve Lahore six-inch expellers with six operating on whole cottonseed at the time of the visit. The plant has no preparation equipment. It operates about eight months per year, averaging 1,900 maunds (34 MT) per day with all 12 expellers operating and 900 maunds (16 MT) with six operating. The oil yield is four to five kg of semi-refined per maund of seed, and all is sold to GCP. The soap stock and cake are sold domestically. The seed cost is Rs 70 per maund and the cake price varies from Rs 60 to Rs 75 per maund. Processing cost is Rs 7 per maund. There are three men per shift to operate the plant. Samples of seed and cake for analysis were obtained.

3. Jabbar Oil Mill--Hyderabad. One Lahore four-inch expeller operating on rapeseed. No preparation equipment. There was only one man in the mill filling and weighing cake bags. He knew nothing about the processing rate, yields or cost. Samples of seed and cake for analysis were obtained.

4. Gizri Corporation Ltd.--Daharki. Six Lahore six-inch expellers operating on whole cottonseed only six months per year, with no preparation equipment. The plant processes 1,400 maunds per day, with 4.5 percent residual oil in the cake and sells semi-refined oil, most of which goes to Lever Brothers. Costs were not obtainable.

5. A. Khan Oil Mill--Mondo Derro. Twenty Lahore six-inch expellers with 15 operating at the time of the visit. Processes whole cottonseed only and has no preparation equipment. The reliability of what little information was obtained is questionable. However, the individual in charge did say that the mill operated six months per

year, that the cake produced had five percent residual oil and that there were 62 men total, including the office staff. Other data included whole seed = 35 seer per maund; crude oil = 5 seer per maund of seed; refined oil = 4.75 seer per maund of seed; and charge crushings = Rs 14 per 100 bags (1 bag = 1 maund). Seed and cake samples for analysis were obtained.

High-Pressure Expeller Plants

Wazir Ali Industries, Ltd.--Hyderabad. The equipment is being removed by the former owner, but its destination was unknown. The following were seen.

2 French F-88 presses with 1-7 high 85 inch diameter cooker; 3 Anderson Red Lion expellers with tempering bins; delinters and dehullers (they were partially removed and the total number could not be determined); and 1-5 high crushing roll.

With two French F-88 presses rated about 30 MTPD each, and the three Anderson Red Lion expellers rated about five MTPD each, the plant could have a capacity of up to 75 MTPD of cottonseed. The residual cake oil from the French presses should be less than three percent and from the Anderson about four percent.

Kohlu PLant

Faqeure Mohamid Oil Mill--near Lahore. One kohlu, oxen driven, that processes rapeseed and mustard seed at a rate of one maund per day (40 kg) and recovers about 22.5 kg of crude oil. The cake sells for Rs 130 per maund and the oil for Rs 12 per kg. Two other kohlu plants were found that were not operating.

While traveling from plant to plant the cottonseed stored outside the several gins that were passed was observed. In every case, it was obvious the seed was manually piled with very irregular shapes, having gaping pockets that would hold any rain that fell. Unless the seed is processed quickly after a rain, deterioration will be rapid and costly insofar as oil quality or even seed preservation is concerned.

Confidence in the data obtained from the expeller mills on crush rates, oil in cake and cost cannot be high. In every case, all such data were verbal and none would show any records. As shown in Table 3, the reported metric tons per day crushed per six-inch Lahore expeller varies from 3.5 to 9.3. Similarly, the cost per metric ton processed varied from Rs 175 to Rs 350. The only data

Table 3

Comparison of Lahore Expeller Plants Visited
(Basis: Data Given at Plant)

	Date of Visit				
	10 March	12 March	14 March	14 March	12 March
Plant	El Adahia	-Farooq-	-Gizri--	A. Khas-	-Jabbar-
Number of Expellers	3	12	6	20	1
Size of Expellers	6"	6"	6"	6"	4"
Number Operating	2	6	6	15	1
Months/year Run	4	8	6	6	-
% Capacity Utilized	22	34	50	38	-
Seed Processed	Cotton	Cotton	Cotton	Cotton	Rape
Rate MTPD	7	36	56	-	-
MTPD/Expeller	3.5	6	9.3	-	-
% Oil in Cake	4-5	-	4-5	5	-
Oil Yield--% Seed	11	11.2	-	14.3	-
Rs Cost/Ton	325	175	-	350	-

Percent Total Capacity Utilized = 35

Seed Analysis:	-MTS-	-MTR-				
Percent Water	7.33	7.76	8.52	8.99	6.94	7.45
Percent Oil	20.37	20.63	15.45	18.32	18.34	40.35
Percent Protein	17.77	16.18	14.90	16.06	16.72	21.60
Percent FFA	4.11	3.99	7.58	3.95	1.96	-
Cake Analysis:						
Percent Water		7.74	8.21	8.82	7.61	8.65
Percent Oil		7.69	5.61	8.45	6.25	9.03
Percent Protein		20.46	19.10	19.32	19.67	33.62

Note: Seed and cake analysis use as reported by a laboratory given the samples obtained from plants.

obtained that was relatively close between plants was the reported percent oil in the press cake and oil yield as percent of seed crushed. It is not believed to be possible to recover that much oil with the small amount of energy input to the expellers. In every plant that had amp meters, motors were seen pulling only 10 to 20 percent of their full load. Oil cannot be expelled without an energy input to the expeller screw.

As stated above, samples of the whole cottonseed to be processed and of the cake produced in the Lahore expeller plants were obtained and delivered to the Paramount Testing Laboratory in Karachi for analysis. The results confirmed the suspicion that the oil content of the expeller cake was much higher than that reported by the plants. Only the Farooq plant in Hyderabad was producing a cake with less than six percent residual oil. Plant officials said they did know the oil content of the cake but that they recovered 11.2 percent of the seed as semi-refined oil. The expeller cakes from the other plants contained from 6.25 to 8.5 percent residual oil, 1.5 to 2 times higher than they reported at the time the samples were obtained.

III. Conclusions from the Plant Visits

Assuming the oilseed processing plants visited are representative of the entire industry in Pakistan, only 35 to 40 percent of available capacity is being utilized at this time.

The low-pressure Lahore expellers were crushing whole cottonseed. With no lint or hull removal before pressing, the reported crude oil yield is about 11 percent of the seed weight processed (110 kg/MT). If the low oil content lint and hulls were removed, oil recovery would be increased to about 13 percent of the seed weight processed (130 kg/MT), or a gain of 20 kg of crude oil per MT of seed processed in these same plants.

Solvent extraction plants were idle or processing rice bran or rapeseed press cake on a limited basis. Solvent extraction of delinted, de-hulled cottonseed followed with conditioning and flaking would yield over 16 percent of the seed weight as crude oil (160 kg/MT). This would be a gain of 50 kg of crude oil per MT of cottonseed over the yield from the present expellers crushing the whole seed. In addition, the solvent extracted meal would be much more nutritious in animal feed rations than the high oil, lint and hull-laden expeller cake. It is unfortunate that in an area that needs edible oils, the potential increase from 110 kg crude oil to 160 kg per MT of cottonseed cannot be attained. If government controls have any effect on the problem, and if those government controls were lifted, there is no justifiable way cottonseed processing could be diverted from expeller plants to solvent extraction plants in the short term.

Granted that solvent extraction capacity is available, there are other considerations, however, that cannot be ignored. For example:

1. Animal feeders, other than possibly poultry feeders, apparently believe high oil cake is better in the ration than the lower-oil, higher-protein extracted meal. A massive education program is necessary to

convince them otherwise. This will undoubtedly be a difficult, long-term process.

2. If the processing were suddenly diverted from the many expeller plants to a few large extraction plants, the economic and social effect would be devastating.

3. The small expeller plants cannot justify the addition of linters, hullers, hull beaters, rolls and cookers to improve oil recovery by 20 kg per metric ton of seed because most of them have too small a capacity.

4. Similarly, it would not be practical to delint and dehull at the gins due to the more rapid increase in free fatty acids after dehulling. Seed should be dehulled just before processing.

5. Cottonseed press cake as now being produced cannot be solvent extracted like rapeseed cake due to the lint. Lint prevents percolation of solvent by plugging drainage openings. In addition, when lint gets to the desolventizer, it is carried with the vapors and soon fouls the first stage evaporator and condenser. Lint must be kept out of the solvent extraction plant.

The long-term solution to the utilization of more efficient solvent plants appears to be getting animal feeders, particularly buffalo owners, to accept the low-oil, high-protein meal in the ration and discourage or prohibit additional low-pressure expeller and kohlu plants. As oilseed production then increases, it must be diverted to larger centralized solvent extraction plants as much as possible. To accomplish this would be a long and very difficult undertaking.

Cottonseed storage practices should be improved, especially as the product increases. Instead of the haphazard piling now used, the seed should be elevated to the height desired and horizontally conveyed to the length desired. The free-falling seed will then form a pile with smooth sides of the angle of repose. Such a pile will shed water and seed can be held for several months. In all cases, there should be an aspiration duct running the full length of the pile for aeration to aid in prevention of hot spots. Temperature sensors should be inserted and monitored to detect any hot spots developing so proper measures, either immediate processing or moving and blending with cool seed, can be started.

IV. The General Art of Oilseed Extraction

In principle, the oil milling process is straightforward. However, a wide variety of equipment is in use and reflects

variations involved. These variations are not limited to the various oilseeds, but occur in equipment for the same seed due to different growing conditions such as climate, soil and even harvesting and storage, making the milling process more of an art than a science. The controls for efficient operation begin with the harvesting through proper strrage and preparation before the oil extraction, whether by pressing or solvent extraction.

Harvest should be after seed maturity and during periods of low moisture content in the seed. Immature seeds generally yield less oil that tends to be more green in color. Wet seed, over 12 percent water, must be dried before storage to prevent natural heating which causes marked increases in FFAs, or even complete spoilage due to charring and sometimes actual burning of the seed. Rough cleaning to remove foreign matter is desirable before storage.

Seed storage should be inside if at all possible, with aeration available and continuous monitoring to detect any termperature rises. Properly stored and monitored oilseeds can be held for up to a year or more before processing with very little deterioration in oil quality. Should "hot spots" be detected the seed must immediately be pulled from storage and processed or blended with dry, cool seed and returned to storage. Blowing dry air through the seed in storage also aids in preventing heating.

Cottonseed is stored outside more than other seeds. It should be elevated to the height desired and dropped freely from a conveyor to the ground over an air duct. The seeds spread and form sloping sides of the angle of repose, allowing rain to run off. It should never be piled manually as humps and valleys will be formed that will hold water and cause heating and spoilage. When the seed is removed from storage for processing, proper preparation is necessary for efficient oil recovery. Preparation is the heart of any oil mill because the best presses or solvent extractors with top-notch operators cannot separate the oil efficiently from improperly prepared seed. Cleaning to remove additional foreign matter and dust is preferred before processing.

Some seeds, such as sunflower and safflower, should be decorticated before seed preparation. Cottonseed should be de-linted before de-hulling. This removal of low-oil hulls improves oil recovery, particularly in press mills, and increases the protein in the cake and solvent-extracted meal. Soybeans can be de-hulled if high protein meal is desired.

Oilseeds are composed of many small cells. The cell walls contain the oil as well as protein and are impermeable to the oil. Consequently, preparation consists of breaking the cell walls to allow the oil to get out when pressing, or the solvent to get in when extracting. This is normally done with crushing rolls or cracking rolls and sometimes by grinding. However, getting the cells broken is not the only factor in the separation process, as the solid matter must form a porous structure to allow the oil to come out. This is accomplished by cooking or conditioning,

adjusting the moisture and elevating the temperature over a period of time. For direct extraction by solvent, most conditioned, broken seeds are flaked to give more tearing action on the cells and to allow better solvent percolation through the bed of flakes. Preparation as above will maximize oil recovery from either the pressing or solvent extraction processes.

High oil content seeds--30 percent or over--are normally prepressed to reduce the oil content to under 20 percent before solvent extraction of the press cake.

The above is a very brief and simplified outline of oilseed processing.

EDIBLE OIL REFINING IN PAKISTAN:

THE STATE OF THE ART

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March, 1983

A. Summary and Recommendations

1. Edible oil processors in Pakistan are faced with an inability to operate at a profit due primarily to cost controls of raw materials and finished goods, coupled with rising operational costs of utilities. Possible solutions are:

   a. Removal of cost controls or equitable taxing of domestic and imported oils.

   b. Development of bulk oil customers to eliminate packaging material and labor costs.

   c. Investigation of alternate packaging materials (rather than metal cans).

   d. Reorganization of plan work force for efficiency improvements.

   e. Elimination of re-refining of oils before final deodorization by implementation of proper batch deodorization conditions.

   f. Development of weight control programs for finished goods.

   g. Investigation of bulk oil movements by rail freight.

2. Oil supply is a serious problem. Most plants are unable to procure enough domestic oil to run more than half the year and must rely on imported oil for the balance. Even volumes are regulated by the Trading Corporation of Pakistan (TCP). Variations in crude oil quality or plant demand are largely ignored.

3. While there are Pakistan Standards Institute (PSI) product standards for "vanaspati" and "margarine," there are none for "cooking oil." Several companies are manufacturing a product they label "cooking oil" which is being sold and used as vanaspati. As the market for cooking oil increases some guidelines should be developed. Source oil labeling requirements should be incorporated into Pakistan's food rules.

4. Refineries in Pakistan are about 50 years behind the state-of-the-art in edible oil processing. Most are operated on a "batch" basis, with resultant inefficiencies in production and higher costs.

5. There is little evidence of expansion of processing operations, even in plants running virtually all year. Capital is expended on a replacement basis.

6. Two companies expect to be in margarine production by next year: Burma Oil Mills, Karachi, and Level Brothers Pakistan, Rahimyar Khan.

7. Many refineries are selling by-products of their operations: soap from acidulation of soap stock and reclamation of oils from spent clay and oxygen and/or dry ice from electrolytic production of hydrogen.

8. Sanitation is poor in most plants.

9. Most plants have large maintenance forces to assure operating continuity. These groups seem to be able not only to repair most plant equipment, but to fabricate duplicate or improved models. Annual shut-downs of two or three weeks' duration for inspections and maintenance are common.

10. All edible oils of the cocoa butter type are imported as finished oils. Since there appears to be a substantial market for these products, and the technology of their processing is similar to that for oils already used, it is logical to expand domestic processing to include them.

11. Crude oil receiving and storage facilities appear to be rudimentary but acceptable for current and expanded production volumes.

12. Interruptions in natural gas and electricity sometimes curtail plants' ability to generate hydrogen gas. GOP's placing edible oil processors on an "essential" industries list would eliminate that problem.

13. The production of "bakery shortening" by one producer could be expanded to include a whole family of baking specialty fats with color, flavor and emulsifiers. This expansion would require customer education and development.

14. The manufacture of emulsifiers (mono- and diglycerides and propylene glycol monoesters) for food use is a logical extension of the edible oil plant business.

B. How the Study was Conducted

Eight refining/packaging plants and two cottonseed expellers were visited. A questionnaire was used to develop complete operational details, followed by plant tours to observe actual operations. A copy of the form is attached as Appendix 1. Plants visited were: Burma Oil Mill, Karachi, A B Oil Mill, Karachi, E M Oil Mill, Karachi, Bengal Vegetable Industries, Ltd., Karachi, Wazir Ali Oil Mill, Hyderabad, Hydari Industries, Hyderabad, Lever Brothers Pakistan, Rahimyar Khan, Star Oil Mill, Sukkur and Ginzi Corp., Ltd. Oil Mills, Sukkur. After each plant

was visited, discussions were held with top plant operating personnel and, in some cases, government officials.

C. Oil Supply

At the beginning of each crop year, refiners request the volume of each type of oil they wish to process during the year from the TCP. They are instructed on the quantity and source of each type of oil they can obtain. According to plant administrators, this means they have very little ability to avoid poor-quality crude oil suppliers or to vary their quantity based on actual demand. Once the domestic oil supply is exhausted, as it is every year, they are forced to shut down or to run imported oil. For plants located at significant distances from a port, freight costs can become the difference between profit or loss for a product.

Cottonseed oil is the most readily available domestic oil. A few plants are processing sunflower oil for cooking. Domestic soybean oil (SBO) is in very short supply as is rapeseed and mustard oil. Plant officials were unable to recall processing domestic crude SBO in any plant visited. Most of the domestic SBO is processed in the NWFP where it is grown.

Crude cottonseed oil (CSO) is crushed from the seeds at the mill. It is caustic, washed at the mill by a process more art than science. Crude expelled oil is put in a large iron kettle, heated and diluted caustic added until the mix "feels" right to the refiner. Soap stock is drawn off and the washed cottonseed oil (WCSO) is ready for shipment to refineries. This WCSO has a free fatty acid (FFA) content of about 0.08 percent to 0.20 percent. According to mill operators, about five percent is lost in the caustic wash operation.

D. Oil Receipts and Crude Storage

All refineries receive their crude oils in 8.5 to 9.0 metric ton tank trunks. Trucks are weighed into the plant, sampled and when approved, unloaded. Unloading usually consists of opening a valve on the truck bottom and letting the crude oil gush out onto a concrete pad with a sump pump lift to crude storage. No facilities for receipt of several types of crude oil simultaneously (separated) were observed.

Oils are sampled and analyzed before unloading. Typical tests are FFA, moisture, mineral oil (to check for contamination) and melting point. Most plants have established limits for these analyses and oils may be segregated based on analysis. Oil is rarely rejected. Off-standard material is usually blended with

other crude oil. There are no standard analyses for oil acceptance or rejection; however, a supplier may discount the oil if its quality is poor.

Oil receipt weights are verified by weighing the empty tanker after unloading. Generally, tankers are steamed out by the receiving plant. Most plants do not have heating facilities for trucks.

Plant crude oil storage capacities range from 1,200 to 4,500 metric tons. Excpt for crude palm oil storage tanks, most of these tanks are unheated and unagitated. Palm storage tanks usually are equipped with heating coils.

Free fatty acids of crude CSO received at the plants are very low--0.06 percent to 0.20 percent due to the caustic wash at the mill. No data for other domestic oils were available.

For imported crude, degummed SBO FFA values were typical--0.7 percent to 1.5 percent. Palm oil from Malaysia is no longer exported crude but refined, bleached and deodorized. FFA ranges from 0.1 percent to 1.0 percent.

Since oil storage time is short (due to small inventories), there is no significant increase in FFA during crude oil storage.

Although receiving and storage facilities are somewhat rudimentary, they are adequate for current and expanded production volumes. Generally, good operating techniques are used for plant cost control and quality acceptability.

It seems feasible that some operational cost savings could be realized by use of rail freight to move imported oils from port to plant.

E. Refining

Most plants visited operate seven days per week, shutting down for an annual inspection of two or three weeks and about sixteen festival days.

Refining is a process in which crude oil is mixed with dilute caustic (usually sodium hydroxide). The free fatty acids of the crude oil form soap. The soap is then separated by settling or by centrifugation (in a continuous system). The refined oil is mixed with hot water and the soap remaining in the oil after refining dissolves in it. The hot, soapy water is drawn off (again by settling or centrifugation). Refined oil is the product of this process.

Three continuous refining systems were observed. Two were based on Sharples machines 20 to 25 years old. The third was an Alpha-

Laval system of about the same age. Caustic addition controls on one were only two years old, but the others were manual. Capacity of the systems was similar--60 to 75 metric tons/day. Refining conditions in all three were similar, except one refinery was using unusually cold wash water (only 160 degrees F). All reported acceptable oil losses; however, they did not divulge actual figures. Refined oil FFA was acceptable. For SBO and CSO, FFA was 0.05 percent to 0.06 percent. Refined CSO color ranges from 1.5 R to 8.0 R.

Five batch-type refining operations were observed. A batch operation is defined as a single unit of oil refined separately from other units. Batch sizes vary from as small as 5.5 metric tons to 13 metric tons. Plants have one to three batch kettles. All five plants process similarly, varying only caustic strength, percent treat and temperature. Again, all plants reported "normal" losses.

General conditions of all refineries were similar--acceptable operational parameters, unacceptable sanitation and old equipment.

F. Pre-Bleaching

Pre-bleaching is essentially a color removal operation. Refined oil is mixed with a suitable bleaching clay, usually at a high temperature under vacuum. Color bodies and any small remaining soap in the refined oil is absorbed on the surface of the clay. The oil is cooled and clay is removed by filtering through either a plate and frame press or a pressure leaf-type filter.

All bleaching systems observed were batch processes. Batch sizes range from 3.5 to 20 metric tons. Most use clay from China, Japan and/or Korea. Percent treat is consistent throughout at 0.5 percent. Bleaching time varies from 20 minutes to one hour. Temperatures vary widely--105 degrees C to 190 degrees C.

While all plants cool the batch before filtration to remove bleaching clay, some filter far too hot. The result of hot filtration is oil quality degradation. Two types of filters are in use: tank type filters (Niagra) and plate and frame presses. The plate and frame type is most common. It is practically impossible to have good sanitation with plate and frame presses. The plate and frame presses are not being blown dry in any operation observed. This results in a high percent of oil retention in the clay and is costly. A dry press cake, which should contain about 40 percent oil, makes an excellent livestock feed.

There is virtually no storage of refined, bleached oil in the plants. Plants may hold 25 to 40 metric tons but generally, bleached oil is immediately hydrogenated.

Although the process is very elementary, the batch method produces acceptable oil. As expected, there is a slight rise in FFA during bleaching since acid-activated bleaching clay is used. Plant pre-bleaching capacities have scarcely been reached. As with other operations, sanitation is generally poor around batch bleachers and plate and frame presses.

G. Hydrogen Gas Generation

Hydrogen is used to change the melting point of oils. This "hydrogenation reaction" is conditional on several factors, one of which is the purity of the hydrogen gas used.

Hydrogen is generated in two ways in Pakistan: electrolysis and cracking of natural gas. Only two plants were cracking natural gas. One of these was producing a very low-purity gas (94 percent), probably as a result of poor scrubbing of the cracked gas, but the other was marginally acceptable (98 percent). Most plants seemed to have excess hydrogen gas production capacity and several were actually bottling and selling compressed hydrogen.

Plant operation people are concerned about natural gas availability. It is frequently shut off and the price is steadily rising. (GOP could provide natural gas and/or power to food producing plants as an "essential" industry.)

Several plants do have stand-by generators for safety in the hydrogen plant in the event of a power failure.

I. Hydrogenation/Post-Bleaching

Hydrogenation is a means of converting liquid oils to semi-solid, plastic fats suitable for shortening or margarine manufacture. It has other effects as well, such as stability improvement and color reduction. Hydrogen is chemically added to the oil by using heat and pressure in the presence of a metal catalyst, usually nickel. The reaction is controlled to a specific end point. When the desired end point (usually melting point) is reached, hydrogen is shut off and the batch is cooled and filtered to remove the nickel catalyst.

Post-bleaching refers to a final filtration of the refined, bleached and hydrogenated oil, and is identical with the operation described under pre-bleach above.

All CSO, SBO and other commercial oils (except palm) used to make vanaspati are hydrogenated before use in a finished product. Some plants prepare the blend before hydrogenation, while others hydrogenate and then blend. Hydrogenation is a batch process carried out in a vessel called a converter. Converters in Pakistan are between three and 13 metric tons in capacity. Typical hydrogenation conditions are:

Table 1

Hydrogenation of Cottonseed or Soybean Oil

Gassing Temperature	140 degrees C
Reaction Temperature (maximum)	200 degrees C
Catalyst, Type	Ni-Harshaw, Girdler
Percent Treat	0.1 + Reuse
Hydrogenation Pressure	PSIG 15 - 25

Three methods of gassing of the batch were observed. In all cases, hydrogen is introduced into the converter at the bottom and bubbles through the oil being hydrogenated while the batch is continuously agitated.

a. Recirculation of hydrogen. The gas is pumped from the top of the converter back into the bottom. (This process has largely been abandoned in the U.S. due to the cost of recirculation pumps and utilities to run them.)

b. "Dead head" method. The gas is introduced into a closed vessel and more is added to maintain pressure as hydrogen is absorbed by the batch.

c. Continuous purge. The gas is purged from the vessel throughout the reaction time.

The end point for these hydrogenations is usually the melting point--35-37 degrees C. Reaction time varies between three and eight hours depending on oil type. The end point is varied seasonally--a higher melting point in summer and a lower one in winter.

Immediately after hydrogenation, the batch is filtered to remove the nickel catalyst, using plate and frame presses in all the plants observed except one, which uses a Niagra tank type filter. Bleaching earth is added to the filtered batch (also

phosphoric acid in some cases), and the batch is filtered again. This post-bleaching operation may occur at somewhat elevated temperatures--140 degrees C. Nickel level is reduced below .2 ppm in the post-bleach process. As in pre-bleach, the press cake is very "wet," indicating too much oil has been left in.

The hydrogenated oils have higher FFA (about .2 to .5 percent) after this operation. Most plants then re-refine (either by batch or continuously) because their batch deodorizers will not remove the fatty acids sufficiently due to inadequate vacuum, insufficient agitation, too low temperature, lack of time or some other unidentified factor. Actually, re-refining should not be necessary if proper batch deodorization conditions are followed. The costs of re-refining only add to the already too high manufacturing costs.

While hydrogenation techniques used are adequate, plants might be operating near their capacities due to inefficiencies in their hydrogenation operations. Certainly, quality is lowered by the techniques they are using.

I. Formulations

1. Vanaspati

The oil type formulation for vanaspati is undefined. When CSO is available, a blend of about 40 percent of hydrogenated CSO (H-CSO), 30 percent hydrogenated SBO (H-SBO) and 30 percent refined, bleached and deodorized palm oil (RBD PO) is used. The blend is usually made and re-refined before deodorization. Since CSO is available only about six months per year, a blend of 50 percent/50 percent H-SBO/RBD PO is used the rest of the time.

There are no source oil labeling requirements in Pakistan, so formulations vary widely among producers. In fact, as the controlled selling prices of vanaspati and domestic oil remain constant, producers are being forced to use more and more lower cost, imported oils.

2. Cooking Oil

In concept, cooking oils are those which remain liquid at room temperature. However, there is no standard definition for "cooking oil" in the Pure Food Rules. Therefore, some companies are labeling any product "cooking oil" and selling it. One such company adds flavoring to RBD PO, labels it "cooking oil" (Marvi brand) and sells it to consumers who use this 100 percent imported RBD PO as vanaspati.

Because there are no controls on imported oil costs nor on the selling price of cooking oil, these unscrupulous producers are making a lot of money and are cutting into the vanaspati market. It is imperative that several inequities be resolved in this regard:

a. Domestic and imported oils must be priced competitively. Government policy on import taxing and domestic price controls should be evaluated. The existing situation gives unfair benefit to imported oils. Until all oils are equivalent or some advantage is given to domestic oils, producers will continue to use the maximum possible of the lower cost raw material.

b. Source oil labeling should be required and enforced on all edible oils. (The main oil should be listed first and so on, down.) Additives such as flavor and vitamins should be included. Generic terms such as "hydrogenated vegetable oil" are unacceptable.

c. Clear definitions of each edible oil type must be written into law. A narrative description of each product type, followed by analytical limits is required to eliminate the blurring of product identities. Expansion and clarification of vanaspati, cooking oil and margarine should be included.

d. Oil standards for trading should be established. Oil can be fairly traded only when certain standards of uniformity are applied. Whether these be FFA, refined oil color or some other anlysis, trading rules are needed.

J. Deodorization

The purpose of deodorization is to produce an oil that is as flavorless as possible and will retain that characteristic for a long time. Deodorization is a steam distillation operation in which steam is bubbled through oil under vacuum, carrying out with it color and flavor bodies. It can be a batch type operation or semi-continuous, whereby the oil is taken through a series of steam distillations.

Only one semi-continuous deodorizer was observed. It was manufactured by Krupp in Germany and had a capacity of 50 tons/day. Oils supplied to this unit were not re-refined and came out of it with acceptable quality (0.05 percent FFA). The deodorized oil was cooled to about 50 degrees and finally filtered through a Sparkler filter before packaging.

Plants with one to four batch deodorizers of capacities between four metric tons and 12 metric tons were observed. All are operated at 180 degrees C. This temperature is low, but the best attainable without super-heated steam. Vacuum on the units varies from as good as 2-3 mm Hg to as poor as 20 mm Hg. Stripping time was four or five hours on all units. Sparging steam volumes could not be obtained. Every batch unit was connected to a final filter and batches generally were cooled to about 70-80 degrees C for the final filtration.

Definite improvements in deodorizing oil, initial quality and shelf life stability could be obtained with better vacuum systems and cooler filtration temperatures. The best batch operation is on a four-hour cycle: two hours at high temperature (450 degrees F) and two hours at low temperature (350 degrees F). Filtration should be at 65 degrees C, maximum.

K. Packaging, Tempering and Warehousing

Vanaspati is always packaged in metal cans in one of three sizes--2.5 kg, 5.0 kg and 16.0 kg. Many plants manufacture their own cans. Sheets of imported tin are stamped, lithographed, soldered and tested in volumes sufficient to support plant production in labor-intensive operations. Each can is handled eight to 15 times before being placed on the fill sequence. The blank sheets of tin are imported mostly from Japan or Australia. Cost of packaging material was unavailable; however, several managers expressed interest in low cost packaging.

With only three exceptions, filling operations were unsanitary, had little or no weight control and were very messy. According to some reports, drips and spills are packaged for "take-home" which encourages them. Cans are filled, stored about 24 hours at room temperature and then cooled in a refrigerated warehouse to about 35 degrees F to allow proper graining. The cans are usually very dirty and labels are often stained. A few plants had some laborers cleaning the cans before shipment.

One company is plasticizing vanaspati into 16 kg tins for sale to the bakery industry. Plasticizing (also called votating) has the effect of producing a homogenous, stable product usable in a wide range of temperatures. Institutional packs of "bakery shortening" are viable additions to all oil packers. Packs in larger than 16 kg sizes could be used to minimize packaging costs. Consumer education on advantages would be necessary. In fact, this type of product could open a whole new family of "specialty baking products" to the market.

The same equipment used to produce this "bakery shortening" has been used for margarine manufacture, and that company plans to roll out margarine production again within the next year. Production of margarine is in its infancy in Pakistan. With

consumer education, it could be an obvious addition to the lines of edible oil products. It is well known that many oils make excellent margarines, so alternate formulae for both domestic and imported oils could be readily developed.

Warehouse capacity ranged from two or three to seven days' production. Warehouses were fairly full, but capacities seem adequate.

L. By-products

One way many plants are offsetting rising costs is by selling by-products of their operations. Many plants use refinery soap stock, oil from bleaching clay and deodorizer distillate to manufacture soap. Several managers reported their soap operation to be profitless, but a way of dealing with soap stock. Other by-products sold include bottled hydrogen, compressed air and oxygen.

M. Other Recommendations for Change

1. Plant Work Forces

GCP plants appear to be heavily overstaffed. Comparing productivity of one of their plants to one in the private sector indicates:

Table 2

Typical Productivity of Workers
Comparison of Private Sector with GCP

19,000 MT annual production 100 employees (private sector plant)	= 190 MT/man
19,000 MT annual production 600 employees (GCP plant)	= 35 MT/man

2. Cooking Oil

This is a relatively new family of products. There is a need for public education concerning these products. Nutritional aspects, product use and handling are basically unknown.

N. Proposed Projects

1. Cooperative projects. Joint ventures between donor agencies and the GOP or some agency designated by the GOP such as GCP or TCP.

   a. It is imperative that larger domestic supplies become available. Production of oilseed crops must be encouraged. Edible oils have always been a by-product industry so a market for meal must be encouraged and developed.

      Education of the cattle/sheep/goat raiser as to balanced animal feed diets is essential. Feedlot studies under the auspices of livestock growing experts are one way of demonstrating the good feed qualities of meal. On-site, regional meetings with farmers and local feedlot owners led by experienced agriculturalists who have fed an assortment of rations to animals over a reasonable period of time con present some very dramatic results. Weight gain and feed conversion data using Pakistani materials should be developed. The value of various meals must be shown to potential users.

   b. Farmers appear to be reluctant to give acres devoted to money crops such as wheat to oilseed production. Some sort of guaranteed sale at a fair, competitive price--forward contracting--could be established. Marketing experts in cooperation with TCP, which already buys all the oil in the country, should develop forms of contracting with farmers/growers. Individuals with experience in grain contracting in countries where this is a common practice would be able to set up a usable system rather quickly.

   c. The import tax structure of oils should be changed to eliminate the current bias. Economists familiar with taxation and its effect would be required to evaluate the situation and recommend changes that would make domestic oils competitive with imported oils. This same team could also work on the following project.

d. Excise taxes should be rationalized to include cooking oil as well as vanaspati and other edible oils. With no tax on cooking oil, companies are reaping unfair profits.

e. Definitions of all edible oils, along with source oil labeling requirements, should be written into food rules. Creation of an enforcement agency should be included in this project. A project of this type would require extensive knowledge of food labeling requirements with a strong background in edible oils. The definitions of various edible oils must be classified. An enforcement agency's duties and responsibilities could be well defined by experienced, quality assurance/compliance personnel and given the authority of government regulations.

f. Manpower requirements and existing staffing in all operating GOP plants should be examined and appropriate action taken. Specific edible oil processing and plant industrial engineering experience will be required to handle this project. If costs are to be brought into line, changes must occur.

g. Evaluation of freight rates and rate control programs to assure equity in edible oil hauling is needed. Feasibility of oil movement by rail with favorable rates could be studied. Transportation rates and controls are complicated. A project to evaluate them would have to be handled by someone skilled in traffic services, i.e., freight rating. Distribution services experience would be a real plus.

h. It is imperative that trading rules be established whereby commodities are traded under uniform conditions.

i. A good manufacturing practices (GMP) act should be written into law so that foods are prepared under recognized, standard sanitary conditions. Programs should be implemented to train plants, to assist in implementing the programs and to create an agency for auditing for compliance. A good technologist with specific edible oil experience could head this project. It would require wide sanitation knowledge and, if involved with actual implementation, traditional quality assurance/sanitation inspection experience.

j. The GOP needs to form an "essential industries" list for curtailment of utilities such as power and natural gas, so these industries continue to operate when necessary--even if cost penalties are necessary. Individuals with public utility experience can perform this type of project. Definitions of "essential industry" would be needed as well as government backing

to set it up through Pakistan's Utilities Commission.

k. Education of consumers concerning nutritional aspects as well as use and handling of cooking oils will encourage the growth of this sector of the market. A home economist television show, newspaper supplements and releases, radio advertising and other forms of public service information could do much to educate the general populace. Information could be disseminated by a public information office. A good journalistic style would be required as well.

l. Spent bleaching clay is an excellent animal feed. A feeding project could be evaluated once the plant's operational problems are eliminated. Agricultural economists could include this project in the feedlot project suggested under "a." above.

2. Donor Projects available to producers on request.

a. Determine the market for institutional products such as bakery specialty fats, emulsifiers, margarines and hard butters. Provide technical assistance in getting the products manufactured. Individuals with experience in these product areas, both in application and manufacture, would be required to develop the information. Market analysts could evaluate the actual demand while food technologists and processing experts could train manufacturers and users.

b. Investigate available alternate packaging materials. Many different ones are excellent for packaging edible oils, but none currently are utilized in Pakistan. Blow-molded plastic or foil-lined cardboard is excellent material. Packaging engineering expertise would be required to do this project. A survey of available materials in this country should be made. Processing/packaging experts could assist plants in developing requirements and new package start-ups, i.e., equipment and materials.

c. Initiate a detailed technical study to identify and correct deficiencies in the batch deodorization process to eliminate re-refining and concentrated, in-depth study of this nature must be handled by an experienced operation person familiar with the technology of edible oil processing.

d. Design and facilitate statistically significant weight control programs for filling operations. These can be justified as cost saving projects. Statistics and quality assurance experience would be required to develop these programs. Variability of packaging

machines would have to be determined and realistic controls set based on their capability.

e. As plants begin to modernize, provide technical information concerning processing operations' state-of-the-art, including technical data. Experienced processors who are knowledgeable concerning the latest equipment and processing information would be required. Regular, country-wide plant visits on a troubleshooting basis by processing experts would be invaluable to plants operating in Pakistan.

APPENDIX I

Edible Oil Processor Report

I. Company name _____

Address _____

Person(s) interviewed _____
Title _____

II. Company Details:

A. No. of employees _____
B. Main products of this plant _____
C. Operations performed here are:

1. Refining _____
2. Acidulation _____
3. Bleaching _____
4. Hydrogenation _____
5. Deodorization _____
6. Packaging _____

D. Oil sold here is packaged in what sizes?
_____

III. Yard Operations

A. How is crude oil received:

Oil Type	Received via
_____	_____
_____	_____
_____	_____

Note: Tankers hold 8.5-9.0 M Tons each

B. Unloading operations observations
_____
_____

C. Sampling _____

D. Storage: Capacity _____
Conditions _____

IV. Refining

A. Batch
1. Batch size_____
2. _____
3. Caustic treat_____

B. Continuous
1. Rate, #/hr_____
2. Mtg. by_____
_____

B. Soapstock disposition_____
C. Process sequence_____
D. Water wash temperature_____
E. Analytical Data

1. FFA	SBO	CSO	PALM
a. crude	___	___	___
b. refined	___	___	___
2. Refined color	___	___	___
3. Other	___	___	___
		___	___

V. Pre-bleaching

A. System description
1. Batch size(s)_____
2. Press type_____

B. Clay
1. Source_____
2. % treat_____
3. Disposition_____

C. Conditions
1. Vacuum_____
2. Temperature_____
3. Time_____

D. FFA rise_____to_____
E. Cool to presses_____
F. Refined/bleached oil storage capacity____

VI. Hydrogenation

A. Hydrogen gas generation
1. Method_____
2. Purity_____
3. Rate_____
4. Storage capacity_____

B. System description
1. Batch size(s)_____
2. Pressure, psig_____
3. Vessel observation_____

C. Hydrogenation Conditions
   1. Temperature, degrees F_____
   2. Pressure, psig_____
   3. Catalyst_____
      a. Mfg_____
      b. % treat_____
      c. Reuse_____
      d. Post-bleach_____
      e. Filter types_____
   4. Other data_____
      a. Control_____
      b. Time_____

D. Analytical Data
   1. Main control test_____
   2. FFA from post-bleach_____

VII. Blending and Re-refining

Describe_____
_____

VIII. Hydrogenated Oil Storage

A. Capacity_____
B. Conditions_____

IX. Deodorization

A. System description
   1. Boiler capacity_____
   2. Steam pressure to plant_____
   3. Number_____
   4. Type (Mfg)_____
   5. Capacity_____

B. Operations
   1. Vacuum_____
   2. Temperature, degrees F_____
   3. Drop temperature, degrees F_____
   4. Time_____

C. Analytical Data
   1. Typical deodorized FFA_____
   2. Other tests_____

X. Packaging Operations

A. Packaging materials_____
_____

B. Observations_____
_____

ECONOMICS OF PROCESSING OILSEEDS IN PAKISTAN

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This paper attempts to describe briefly the Pakistani oilseed processing industry in terms of capacity, efficiency, costs, investment and comparative advantage in the processing of existing oil seed sources.

Capacity Utilization

It is estimated that the quantity of oilseeds and oilseed materials processed by solvent, expellers and kohlus is as follows:

	1,000 Tons				
Method	Cottonseed	Rapeseed	Rapeseed Cake	Rice Bran	Total
Solvent	130	0	30	40	200
Expeller	1,350	120		0	1,470
Kohlu	0	120	0	0	120
	1,480	240	30	40	1,790

On the basis of the above tonnage estimates, it is believed the processing capacity and utilization to be as follows:

	1,000 Tons			
	Capacity	% Utilized	Utilized	Available
Expeller	3,200	45	1,470	1,730
Solvent	500	40	200	300
	3,700	45	1,670	2,030

These numbers are "best guesses" and simply describe the magnitude of the over-capacity situation.

The estimated replacement cost in 1983 for the plants processing cottonseed or rapeseed is as follows:

	Daily Capacity Tons	Rs	$
Cold Press Expellers	14	702,000	56,160
Cold Press Expellers	100	4,752,000	380,000
Solvent Extraction (imported machinery)	100	150,000,000	12,000,000

The expeller operator has a ready demand for the high oil expeller cake from the farmer with some livestock who has the notion that ruminant animals perform better when fed protein products

with high oil content. There apparently is also a preference by some people for crude expeller cottonseed oil found in retail markets at less than the vanaspati price of Rs 11.2 per kg.

Small expellar plants often are operated as neighborhood establishments with a market carved out within "donkey distance" of the source of supply and the market for cake. Supposedly, GCP collects all the oil from about 500 mills at this level.

The large expeller mills simply have more expellers than the small mills and operate in much the same way. However, they are large enough to be more visible and more likely to be controlled in some ways than the small mills.

The solvent plant operators try occasionally to process cottonseed but must gear the production of meal, and therefore oil, to the demands of the emerging poultry industry. Cottonseed meal cannot be used as the only protein source in poultry rations; however, one solvent extraction plant could supply the entire current protein demands of the poultry industry. The solvent plants have been relegated to a position in the market where they can only process the materials that cannot be processed by the expellers. One solvent operator observed that the solvent plants are primarily involved in processing the "junk." He was referring to the solvent extraction of rice bran and rape/mustard cake, supposedly for soap making, and the export of the de-oiled rape and rice meal.

Expellers account for about 86 percent of the cottonseed crushing capacity due to cost-effectiveness and ease of entry. New expeller plants have been built in recent years and there have been capacity increases in existing plants. There has been no increase in the number of solvent plants, and at least one plant has been mothballed and another scrapped.

Over 90 percent of the cottonseed is processed in indigenous low-pressure, screw press expellers. The whole seed, including lint and hull, without cooking, is fed into the screw press and usually the only temperature rise is the result of heat of friction. As a result of this processing method, the oil yield for Pakistan is only about 11 percent once refined (about 60 percent of the oil content), compared with the much higher yields of about 16 percent once refined (88 percent of the oil content), which could be achieved by most of the solvent extraction plants visited that have delinting and dehulling equipment.

If all the cottonseed had been solvent extracted, oil production could have been increased by an average of about 44,000 tons annually for the past five years. However, the expeller plants are extremely cost-effective and produce high oil content cake, a product preferred by the buyer.

For the purpose of estimating the comparative total costs to process cottonseed through expeller and solvent extraction plants, the following are assumed:

a. The cost of cottonseed delivered to the plant sites is the same in all cases. Any differences in the transportation and octroi cost would have to be adjusted on an individual plant basis.

b. All the expeller processing costs are for plants having five expellers, about the average number reported. Generally, plants with fewer expellers would have a higher unit cost, while those with more than five would show lower processing cost.

c. Similarly, solvent extraction plant processing cost estimates are based on 100 metric tons per day (MTPD) of cottonseed.

d. All cost estimates are per one 40 kg maund of cottonseed.

Cost/40 kg Maund of Cottonseed	Expeller Whole Seed	Expeller De-linted Seed	Solvent Extraction De-linted Seed	Solvent Extraction De-linted and De-hulled
Cottonseed	76.50	76.50	76.50	76.50
Transportation	4.00	4.00	4.00	4.00
Octroi	1.15	1.15	1.15	1.15
Total Procurement Cost (Rs)	81.65	81.65	81.65	81.65
Fuel and Power	1.50	2.40	6.10	6.00
Labor	0.80	1.15	1.50	1.50
Handling-- loading, unloading	1.15	1.15	1.15	1.15
Maintenance & repair	0.60	0.75	1.40	1.50
Depreciation-- machinery, bags	0.40	0.50	2.00	2.00
Solvent @ 0.25% loss			1.25	1.25
Caustic soda	0.40	0.40	0.60	0.60
Salaries-- office, mechanical	0.70	0.75	1.00	1.00
Miscellaneous	0.90	0.90	0.90	0.90
Total processing Cost (Rs)	6.45	8.00	15.90	15.80
GRAND TOTAL COST (Rs)	88.10	89.65	97.55	97.45

The expected yields of products from each of the above types of oilseed processing plants are shown in the table below. In each case, the yield is expressed both as a percent of the whole cottonseed processed and as kg per 40 kg maund of cottonseed.

Yields/40 kg/Maund of Cottonseed	Expeller Whole Seed		Expeller De-linted Seed		Solvent Extraction De-linted Seed		Solvent Extraction De-linted and De-hulled	
	-%--	kg/md	-%--	kg/md	-%--	kg/md	-%--	kg/md
Crude Oil	10.98	4.39	11.41	4.57	16.86	6.74	16.40	6.56
Semi-refined Oil	10.65	4.26	11.07	4.43	16.30	6.52	15.87	6.35
Soap Stock	0.55	0.22	0.57	0.23	0.84	0.34	0.82	0.33
Expeller Cake	87.80	35.12	82.32	32.93	---	---	---	---
Extracted Meal	---	---	---	---	76.27	30.51	46.78	18.71
Lint	---	---	5.00	2.00	5.00	2.00	5.00	2.00
Hulls	---	---	---	---	---	---	30.00	12.00
Loss	1.22	0.49	1.27	0.51	1.87	0.75	1.82	0.73
Oil in Cake or Meal	8.00	2.81	8.00	2.63	1.50	0.46	1.50	0.28
Protein in Cake or Meal	23.62	---	25.20	---	27.19	---	41.13	---
Residual Oil in Hulls	---	---	---	---	---	---	3.00	0.36

Using values of products per 40 kg/maund as recently listed by the Ghee Corporation of Rs 268 for semi-refined oil, Rs 60 for soap stock, Rs 200 for lint, Rs 30 for hulls and Rs 69 for cake or meal, the following shows the profit or loss from the type of plants mentioned above. In each instance, the kg of each product and its rupee value is shown for the yield from one kg/maund of cottonseed processed. (Note: Rs 268 per 40 kg/maund for semi-refined oil = Rs 250 per 37.394 kg/maund.)

Product Rs Value per 40 kg/maund of Cottonseed	Expeller Whole Seed		Expeller De-linted Seed		Solvent Extraction De-linted Seed		Solvent Extraction De-linted and De-hulled	
	-kg--	Rs Value	-kg--	Rs Value	-kg--	Rs Value	-kg--	Rs Value
Semi-refined Oil	4.26	28.54	4.43	29.68	6.52	43.68	6.35	42.55
Soap Stock	0.22	0.33	0.23	0.34	0.34	0.51	0.33	0.50
Lint	---	---	2.00	10.00	2.00	10.00	2.00	10.00
Hulls	---	---	---	---	---	---	12.00	9.00
Cake or Meal	35.12	60.58	32.93	56.80	30.51	52.63	18.71	32.27
Total Product Value	---	89.45	---	96.82	---	106.79	---	94.32
Total Cost	---	88.10	---	89.65	---	97.55	---	97.45
Profit Rs/Maund	---	1.35	---	7.17	---	9.24	---	---
Loss Rs/Maund	---	---	---	---	---	---	---	3.13

Assuming the Ghee Corporation price listing on January 22, 1983, was correct and is still applicable, it is apparent oilseed processing plants should be delinting cottonseed before pressing. The expeller plants would profit by an additional Rs 5.8 per 40 kg/maund of cotton processed because the lint is worth more than the cake and additional oil would be recovered by removing it. It would appear the solvent extraction plants would be very competitive when processing delinted black cottonseed. The delinting would have to be very complete, and the MTPD through the extractor would be lower due to the additional bulk of the hulls.

Using the above total value for all processing products, except cake and meal from the above types of plants and their total cost, the necessary meal value per 40 kg maund to break even is shown on the table below.

Rs/40 kg Maund of Cake or Meal to Break Even	Expeller Whole Seed		Expeller De-linted Seed		Solvent Extraction De-linted Seed		Solvent Extraction De-linted and De-hulled	
	-kg--	Rs Value	-kg--	Rs Value	-kg--	Rs Value	-kg--	Rs Value
Grand Total Cost	---	88.10	---	89.65	---	97.55	---	97.45
Products Other Than Cake	---	20.87	---	40.02	---	54.19	---	62.05
Necessary Cake Value	---	59.23	---	49.63	---	43.36	---	35.40
Cake Value/Maund	35.12	67.46	32.93	60.29	30.51	56.85	18.71	75.68

If the price of semi-refined cottonseed oil were increased to 300 Rs/40 kg maund (280.45 Rs per 37.394 kg maund) and other products remained the same, the necessary meal value per 40 kg maund to break even would be:

Cake or Meal Rs/Maund to Break Even with (300-268) 32 Rs Oil Increase in Value	Expeller Whole Seed		Expeller De-linted Seed		Solvent Extraction De-linted Seed		Solvent Extraction De-linted and De-hulled	
	-kg--	Rs Value	-kg--	Rs Value	-kg--	Rs Value	-kg--	Rs Value
Grand Total Cost	---	59.23	---	49.63	---	43.36	---	35.40
Increased Oil Value	4.26	3.41	4.43	3.54	6.52	5.22	6.35	5.08
Necessary Cake Value	---	55.82	---	46.09	---	38.14	---	30.32
Cake Value/Maund	35.12	63.58	32.93	55.99	30.51	50.00	18.71	64.82

A 12 percent increase in the value of semi-refined cottonseed oil would make solvent extraction plants cost-competitive with expeller plants if cake and meal values were the same.

Rapeseed/Mustard

It is estimated that half the rapeseed is processed by kohlus in the villages and the other half by expellers. The solvent plants de-oil about 40,000 tons of rapeseed cake previously processed by kohlus or expellers. The loss of rapeseed/mustard oil through kohlus and expellers is about 14,000 tons more than the loss through solvent processing. However, the cost-effectiveness and low investment of kohlus and expellers precludes the use of solvent extraction for rapeseed/mustard seed.

PART V

OILSEED CROP RESEARCH AND PRODUCTION

RESEARCH, PRODUCTION AND ALTERNATIVE CROPS: AN OVERVIEW

A. Summary and Recommendations

1. The gap between production and consumption of edible oils is growing at the rate of about 50,000 metric tons per year in Pakistan and increases in production are necessary to fill this gap.

2. Developmental production research conducted mainly in farmers' fields is needed to begin to fill this production gap.

3. Increases in production of oilseeds need not replace production of major crops because millions of acres of dobari or rice-fallow land, cotton-fallow land and kacha land are available. From 30 percent to 50 percent of these lands are cropped, often with very little input or care. Of the estimated 13.5 million acres of these lands, about 6.75 million acres could be planted to nontraditional oilseed crops. If both traditional and nontraditional oilseeds are produced on the acres, even with no increase in production per acre for traditional oilseeds, more than enough oilseed would be produced to fill the edible oil shortfall.

4. The present research on oilseed production is inadequate. In order to increase production significantly, adequate funding is needed for both adaptive and developmental research.

5. There is a weakness in the present system of disseminating research information to the farmers. Farmers' fields should be used for the proposed research projects so the results will be observable to other farmers. It will be the responsibility of the researchers to put the field research data into a form that is usable to farmers.

6. Ten development or adaptive production research projects are proposed to encourage development of edible oilseed production in Pakistan. These projects are:

a. Dabari Project. To encourage production of sunflower, safflower or mustard and rape on land that may be idle after rice production.

b. Cotton-fallow Project. To encourage production of sunflower and soybeans on land that may be idle after cotton production.

c. Kacha Project. To encourage production of mustard, sunflower and safflower after waters recede from flood stage along the rivers. This land is, at best, often poorly utilized.

d. Groundnut Development Project. To increase production of peanuts on farmers' fields by applying known technology. Peanuts can be grown in the rainfed areas of the NWFP and Baluchistan, but yields are low because farmers do not use the best production technology. Peanuts can fit into a rotation on the barani, rainfed areas. They have high yield potential and offer a lot of promise in this area.

e. Legume Inoculum Research-Development Project. To bring inoculum into commercial production for soybeans and groundnuts. This will require private sector participation to determine commercial input requirements. High inoculum usage would reduce the production cost of these two crops.

f. Machinery Development Project. To increase efficiency in production and harvesting as a vehicle for adaptive research on existing farm implements. Threshing, as it is now done, is too slow to allow sufficient time for the farmer to plant, harvest and thresh an oilseed crop before it is necessary to plant the next crop. An improved but inexpensive thresher is the solution to this problem. Improved tillage implements and seeders to get better germination and more even stands are other areas for research.

g. Integrated Economic Research Project. To integrate economic analysis into all of the development and adaptive research projects. Farmers must be convinced that the added oilseed crops will result in a sufficient financial reward over and above costs. Research is needed to determine the optimum inputs and the effect of introducing new crops on yields of crops in the existing rotation. This information should be transmitted to farmers in a usable and understandable form.

h. Seed Production Research Project. To develop a working, quality seed production program by encouraging the existing, but limited, seed production program. An experienced expatriate seedsman will help develop acreages of seeds already tested in Pakistan and help establish government concessions to encourage private entrepreneurs to produce sufficient seed.

i. Research Augmentation Project. To help the coordinator of oilseed crops administer the crop improvement and crop production systems projects.

j. Training Coordinator Project. To handle training as needed by the respective projects.

B. Method of Study

Publications that were used as sources of information are listed in Appendix 1. Four reports were prepared which describe an existing situation and make recommendations for improvement. These reports are W. J. Amen, "Oilcrops Seed Industry in Pakistan;" B. L. Brooks, "Integrated Economic Research on Edible Oilseed Production in Pakistan;" R. G. Hansen, "Soybeans, Peanuts and Crop Production Systems;" and P. F. Knowles, "Research and Development of Oilseed Crops in Pakistan." These reports have been condensed into a report that deals with the existing situation in terms of its strengths and weaknesses and the changes required.

C. Summary of Report

1. The Existing Situation: Strengths and Weaknesses

a. Production

Oilseed crops in Pakistan are classified as traditional and nontraditional. Traditional crops are those with a history of commercial production going back several years, while nontraditional crops are those recently introduced to Pakistan. Nontraditional crops of importance are sunflower, safflower and soybean. Table 1 gives acreages and production of these crops over a period of years.

Development of acreages of nontraditional oilseed crops has been a responsibility of the Ghee Corporation of Pakistan (GCP), Seed Division, Lahore. It is apparent that acreage of traditional crops have stabilized and acreages of nontraditional crops have not increased as rapidly as planned. Average yields continue to be low.

Continued low average yields are due to many factors. Among these:

- Continued use of unimproved cultivars. This is particularly true of rapeseed/mustard and groundnuts. Improved cultivars are not moving rapidly from research institutes into commercial production.

- Variable and often poor stands. This is due in some instances to the use of low germination seeds, especially in soybean and sunflower. More often, however, poor stands have resulted from poor seedbed preparation, poor planting techniques, or both.

Table 1
Hectares of Sunflower, Safflower and Soybeans in Provinces of Pakistan, 1976-1981

Year	Punjab	Sind	NWFP	Pakistan*
		Sunflower**		
1975-76	481	2	--	483
1976-77	389	--	--	389
1977-76	--	19	18	37
1978-79	247	220	12	479
1979-80	267	247	78	492
1980-81	2,634	247	84	2,965
		Soybeans**		
1975-76	--	2	831	833
1976-77	--	52	1,610	1,662
1977-78	--	76	2,973	3,049
1978-79	--	140	3,297	3,437
1979-80	--	168	3,344	3,512
1980-81	--	168	2,887	3,055
		Safflower***		
1978-79	--	--	--	1,258
1979-80	--	--	--	987
1980-81	--	--	--	4,490

*No oilseed production is reported for Baluchistan Province.

**Agricultural Statistics of Pakistan, 1981, pp. 61 and 63.

***Agricultural Development Project PC-1 form. Ghee Corporation of Pakistan, Seed Division, Lahore, p. 9. No data on safflower was found previous to these years. Almost all of the area shown here is in the Sind and South Punjab.

- Inadequate nutrition. In the case of many oilseed crops, in contrast to the situation in wheat, fertilizers were not applied. Inadequate nutrition was evidenced by a light green color and the presence of a few vigorous, dark green plants that obviously enjoyed a supply of supplemental nutrients.

- Inadequate control of weeds. With the increasing costs of hand labor and general poor crop stands, this problem is likely to increase.

- Damage from insects. Most severe in this regard would be damage by aphids to rapeseed/mustard and safflower.

- Damage from disease. On the whole, losses from diseases have not been as severe as losses in wheat to stem rust. Safflower has suffered severe losses to leaf blights in some years and soybean has been attacked by a leaf virus.

- Losses to birds. Like most crops, oilseeds can suffer severe damage from birds. Most severe has been damage to sunflower, particularly in isolated small fields.

- Equipment problems. There was a lack of suitably designed and affordable equipment that would improve production through better seedbed preparation and controlled seeding rates with provision for making banded applications of fertiliers at recommended rates. There was also a lack of machines for controlling weeds and for improved threshing. In the case of peanuts, there is an urgent need for an improved bullock-powered digger, a mechanical picker and a mechanical sheller.

In the case of the nontraditional crops, the acreage being developed by GCP is scattered over a very wide area. This leads to inadequate supervision and difficulties with delays in the lifting of the harvested crop. Some concentration of the acreage of each crop would be desirable. This may be difficult because of farmer resistance to the culture of new crops.

There is too much dependence on introduced supplies of planting seed of sunflower and soybeans. Introduced seed has been expensive and sometimes has had low germination because of exposure to very high temperatures and/or humidity in transit or in storage. Delays in receipt of seed have led to delays in planting dates. There is a strong need for a local seed industry to undertake the production of a high quality planting seed.

Similarly, there is no local source of Rhizobium inoculum for soybeans or groundnuts. Development of local commercial production of inoculum could provide a high quality product for not only soybean and groundnuts, but also for other legume crops.

There has been very little research done on the cost and returns from nontraditional and traditional oilseed crops. No comparative return studies have been found for any of these crops. If a farmer is to make decisions on the choice of oilseed or other crops on fallow, kacha or rainfed lands, he needs to know which crop will maximize returns.

There is evidence that specific sequences of crops result in higher yields. Research is needed to verify or refute this and determine the economic consequences.

Research is also needed to determine the optimum level of inputs into an oilseed crop. Very small amounts of fertilizer and pesticides are now used on oilseeds.

Farmers respond to new income opportunities but need to be informed of the best alternatives. Economic analysis and development research conducted on farmers' fields is required to develop extension information.

b. Research

Research programs on oilseed crops have largely been centered at the provincial research institutes and at the National Agricultural Research Center (NARC) in Islamabad. Coordination of oilseed research programs nationwide has been provided by the Oilseed Research Coordinator at NARC. Federal funds to finance provincial research have been channeled through the Pakistan Agricultural Research Council (PARC). Following are evaluations of research:

- Research being done at research institutes is variable in quality. Research under the direction of Abdul Qadim Syed at the Agricultural Institute (North) in Swat Valley and Altaf Hussain Chaudhry at the Tandojam Agricultural Institute is of very good quality.

- In the provinces, improved cultivars and technology developed through research are being transferred very slowly to farmers. This may result from limited research/extension contact. Even more serious is the failure of researchers to demonstrate improvements in cultivars and production technology at the village level. This could be the result of inadequate budgets and transportation.

- There is very little research into the feasibility of using dobari, cotton-fallow areas and kacha (riverine)

lands for oilseed crops. The vast size of these tracts dictates that such research be expanded without delay.

- The Oilseed Research Coordinator at NARC has over ten species of oilseed crops under his supervision--too many to permit him to supervise national research programs on all of them. One or more oilseed advisors are neded to give him backup support.

- Because there are a great many oilseed crops, each with its own growth pattern and problems, financial resources have been spread very thin.

- Research on groundnuts has been seriously neglected and is far behind needs. There is no strong linkage between oilseed researchers in Pakistan and the groundnut program at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), where major research attention is being given to groundnuts and important advances have been made in cultivar improvement and production technology. The latter program provides segregating populations from many crosses, some very difficult to make. These could be grown by oilseed botanists in each province and promising selections could then be made.

- Research into the development of double-zero <u>Brassica juncea</u> (raya) is being given insufficient emphasis. Already zero-erucic acid types are available in Pakistan and low gluosinolate types should soon be found. A double-zero raya would have great potential in meeting part of the edible oil needs of Pakistan. The oil would be similar to soybean oil in fatty acid composition, and the meal could be used in rather large amounts in livestock and poultry rations.

- With a few exceptions, there has been insufficient liaison between oilseed researchers and the GCP. Closer cooperation would benefit the GCP through immediate application of research results and would benefit researchers by acquainting them with crop problems that need research.

- Financial support for research, particularly that at provincial institutes, has been inadequate. Often, the transfer of financial support from PARC to research stations away from Islamabad has been delayed. This sometimes results in the loss of staff.

The failure of research units to provide improvements in cultivars and production technology has particularly harmed development of new crops where the farmers have had no prior experience. Farmers are not likely to adopt new crops until information on yields and inputs are reduced to cost and return figures that are understandable and meaningful to them.

Economic research needs to be done in conjunction with the oilseed production development research on all of the proposed projects. This integration is built into each of the proposed production development projects.

2. Changes Required

Many of the changes required are self-evident and need not be elaborated here. A solution to many of the high priority problems would be provided by adopting the ten development or adaptive production research projects listed on pages 2 and 3 of this paper and described in detail in subsequent sections.

The potential area that could be used to expand oilseed production is estimated to be 7,045,000 hectares as presented in Table 2.

Table 2

Present Use and Estimated Area of Land
That Could be Planted to Nontraditional Oilseed Crops

Description of Land	-1,000- Total Hectares	Estimated Percent for Nontraditional Oilseed Crops	---1,000---- Estimated Area for Oilseeds
Dobari	1,900	30	570
Cotton-fallow	2,800	50	1,400
Kacha (riverine)	4,500*	75	3,375
Intercropped	400*	50	200
(with sugarcane)	6,000	25	1,500

*Estimated by knowledgeable persons in Pakistan.

D. Proposed Projects: A Brief Review

In proposing crop research/development projects the following have been guides:

1. Expansion of acreages of oilseeds should not displace the major crops, including wheat, rice, sugarcane and cotton. Therefore, expansion in oilseed production must come through more productive and intensive

cropping systems on (i) dobari lands; (ii) cotton-fallow lands; (iii) kacha lands; and (iv) barani lands.

2. There should be a steering committee which consists of the (i) Federal Secretary of Agriculture; (ii) Oilseed Commissioner; (iii) Provincial Secretaries of Agriculture; (iv) Provincial Directors of Research and Extension; (v) a representative from PARC; (vi) a representative from the Cotton Committee; and (vii) an expatriate advisor.

3. The developmental research programs or crop production systems research should be administered through the Federal Secretary of Agriculture, directly to the Provincial Secretaries of Agriculture. The provincial institutions have charge of conducting development research to support the crop production systems programs. These programs should integrate the Agricultural Extension Service of the provinces and the field staff of the GCP. Backup support and services should be provided by PARC.

4. Crop improvement research is the charge of NARC which should respond to the needs of the provinces and support their programs.

5. Office, laboratory and field space (except land rented from farmers) will be supplied as much as possible at provincial research institutes and field stations, or provided by NARC.

To bring together an action program, ten projects are being proposed. The following section briefly describes each project.

1. Dobari Lands Project

The dobari lands are those soils cropped with rice during kharif season and left idle or poorly used during winter. The estimated area of these lands is 1.9 million hectares. About 30 percent (0.57 million hectares) of these lands in Sind and Punjab Provinces is considered available for nontraditional oilseed crops--sunflower, safflower--and 70 percent (1.33 million hectares) available for the traditional oilseed crops--rape and mustard.

The major developmental research effort will be crop production systems research and should be conducted at the provincial level. The primary location should be in the Tandojam Agricultural Research Institute (TARI), with three satellite locations in South Punjab, North Sind and South Sind Provinces. This project must be tied closely to the machinery development project to overcome land preparation, seeding and harvesting problems to enable more intensive cropping systems.

One full-time expatriate advisor, a production agronomist, and 1.25 man-years of short-term support are budgeted.

2. Cotton-fallow Project

Of the 2.21 million hectares of cotton, about 30 percent (0.66 million hectares) is left fallow during the rabi season. Much of this land is suited to planting sunflower and soybeans during the January-May period. The project would undertake crop production systems research on this land to increase the planting and management levels of sunflower and soybeans.

This project would be tied to the machinery improvement and Rhizobium inoculum development projects and include a component of the economics of crop production systems intensification. The project should be located in southern Punjab, possibly Multan, where two-thirds of the cotton-fallow is located. A satellite location should be in northern Sind Province, probably Kot Diji.

One full-time expatriate advisor experienced in agronomy and production and 1.25 man-years of short-term support would be required.

3. Kacha Project

The kacha or riverine lands are the lands along the rivers where safflower, mustard and some sunflowers could be planted when the rivers recede after the monsoon rains. This area is estimated to contain one to two million hectares. River control programs are now underway.

An agronomist, soil scientists and agricultural economist should conduct a feasibility study before a final project is prepared. The feasibility study could take up to six months for each of the three consultants.

4. Seed Production Project

A major increase in production of hybrid sunflower, soybean and safflower seeds will be required to meet the needs in increased plantings. By 1988, the estimated area for planting seed production would be: sunflower, 11,250 hectares; soybean, 25,000 hectares; and safflower, 18,750 hectares.

Because of favorable climatic conditions, the Swat Valley and proximate regions are desirable for sunflower and soybeans. These could serve as high-income crops to replace the opium poppy. Safflower seed production would be in Sind Province.

An expatriate project director and seedsman would be required for

three years, with about U.S. $540,000 in seed cleaners and bagging equipment.

5. Legume Inoculum Research-Development Project

Presently, soybean inoculum is prepared by research institutes in Pakistan or imported from the United States. There does not appear to be a suitable inoculum for groundnuts. This project proposed to undertake the linkage of Rhizobium strain selections for the groundnut project and the commercial production of suitable inoculum for soybeans and groundnuts. Efforts would link the groundnut, cotton-fallow and seed projection projects.

The project would need the short-term assistance of a commercial inoculum production specialist and specialized equipment to undertake production.

6. Machinery Improvement-Development Project

Four types of machinery will be needed to intensify the crop production on dobari, cotton-fallow and barani lands: (i) a seedbed preparation implement for dobari lands; (ii) a thresher more suitable for oilseed crops; (iii) planting equipment modified for cotton-fallow lands; and (iv) groundnut harvesting equipment. The project would need to work closely with the respective research-developmental projects for machine design specifications.

The project would require one expatriate advisor plus 0.5 man-years of short-term assistance.

7. Research Augmentation Project

The oilseed coordinator will need assistance to increase the crop improvement programs for the edible oilseed crops and administer the crop production systems research programs. This assistance will be required to coordinate new projects and ongoing oilseed projects. It is proposed that one full-time expatriate advisor and up to 2.5 man-years of short-term assistance with seminars and short courses be provided.

8. Groundnut Research-Development Project

There are only 59,700 hectares under groundnuts in Pakistan. There are 6.0 million hectares of rainfed or barani land, much of which is suitable for groundnut production during kharif season. Major work is required in selections of high-yielding bunch types, production practices, inoculum selection and machinery development for groundnut production. This will

require moving groundnut research to soils more suitable and more representative of the lands on which groundnuts ought to be grown.

9. Training Coordinations Project

Training, both degree and short-term, is a necessary part of each project. Training will be structured to complete course work at a foreign university and undertake research in Pakistan or at an international center on specific problems important to Pakistan. All such training will require the coordination, cooperation and agreement of the student advisors within each institution. Clear-cut staffing and research policies with earmarked financial support would be required to ensure success. Close coordination with the other projects will be required to ensure the timely selection of the best candidates.

10. Integrated Economic Research and Support of Oilseed Production

The dobari and cotton-fallow projects are developmental research programs on crop production systems. Their major thrust is to increase production of oilseeds through more intensive land use. Cost structuring of past and future production practices will be required to bring together the highest return production technology that should be transferred to farmers through extension programs. The production cost of high-quality seeds and incremental cost of improved farm machinery for small farmers must be determined. Farm management programs will need to be developed for Pakistan agriculture.

The project must be linked closely to the crop productions systems projects. As the groundnut and kacha projects develop, an economic component would need to be included.

APPENDIX 1

Reference Materials

Admed, Syed Iftikhar and Zaida, Syed Faiz Admad. "Constraints Which Require Due Attention Before Formulation of Strategies for Agriculture Development." Presented at the Second National Seminar of New Socio-Economic Order for Pakistan on December 31, 1982, Karachi.

Amin, Mohammad. Increasing Deficit of Edible Oil: A Great Challenge for the Country. Ghee Corporation of Pakistan, Lahore, May 1982.

ARI. Early Soybean Variety for Barani Sub-Mountain Areas and Spring Plantings in Plains. Mingora (Swat), NWFP. Bul. No. 7, December 1980.

Chauhan, I.K.S., et al. An Agribusiness Study of Rapeseed and Mustard. Centre for Management of Agriculture, Indian Institute of Management, Ahmadabad. CMA Monograph #52. September, 1974.

Chaudhry, Altaf H. Soybeans: A Potential Crop for Pakistan's Agriculture. Agriculture Research Institute, Tandojam, 1982.

Chaudhry, Altaf Hussain and S. A. Qadeer Farid. "Introducing Safflower (*Charthamus tinctorius*) in Sind." I. Performance of Spiny Varieties. *Pakistan Journal Science Research*, XXVII (1-4) (1975), 41-48.

FAO, United Nations. Technology for Increasing Food Production. TV. INT 285 (SWE). Proceedings of the Second FAO/SIDA Seminar on Field Crops in Africa and the Near East, Pakistan, 18 September to 5 October, 1977. Rome, 1978.

Ghee Corporation of Pakistan. Action Plan for Sunflower. Seed Division, Lahore, Spring 1983.

_____. Edible Oil Production in Pakistan. Lahore, 1982.

_____. Sunflower, Future Oilseed Crop of Pakistan. Lahore, 1982.

Government of Pakistan, Agriculture Statistics of Pakistan, 1982. Ministry of Food and Agriculture PLanning Unit, Islamabad.

Khan, A. Rahman. Current Agro-Technology for Groundnut Production. Crop Production Bulletin No. 3, Pakistan Agriculture Research Council, Islamabad, 1981.

Khan, A. Rahman, Qayyum, Abdul, Ashraf, Mohammad. Cooperative Research Programme on Oilseed Crops. PARC, Islamabad, 1981.

Khan, A. Rahman and Azam, Qazi Tauqir. States Paper on Oilseed Crops in Pakistan. PARC, Islamabad, 1979.

Khan, M. Iqbal. Annual Report of Directorate of Oilseeds, 1981-82. Director of Oilseeds Research Institute, Faisalabad.

_____. Research and Development of Safflower as an Alternate Oilseed Crop. Oilseed Research Institute, Faisalabad, Pakistan, 4th Annual Report, 1979-80. September 1980.

Manderstam, L. H. Report by a Fact-Finding Mission on the Vegetable Oil Industry in Pakistan. The Asian Development Bank. L.H. Manderstam & Partners, Ltd., Consulting Engineers. 39 Grosvenor Gardens, London.

Muhammed, Amir and A. Rahman Khan. Perspective of Edible Oils Research and Production in Pakistan. Pakistan Agricultural Research Council, Islamabad, 1981.

Oilseeds Research Institute. Production/Action Plan, 1980-81, Oilseeds. Faisalabad.

Pakistan Agricultural Research Council. Agro-Economic Regions of Pakistan. Social Sciences Division, Plant Sciences Division, Islamabad, 1980.

_____. Agro-Economical Regions of Pakistan. Social Sciences Divison and Plant Sciences Division, Islamabad, June 1980.

_____. Barani (Rainfed) Agricultural Research and Development Project. PC-1, Revised. Islamabad, June 1982.

Punjab Agricultural Research Coordination Board and Department of Farm Management. Cost of Producing Major Crops in Different Districts of the Punjab. University of Agriculture, Faisalabad, January 1982.

Qureshi, Saeed Ahmed. Strategy for Oilseeds. Ministry of Food, Agriculture & Cooperatives, Government of Pakistan, 1982.

Sabir, Mohammad Idris S., Hussain Shah and Jumshid Khan. "Bacterial Inoculation as an Aid to Soybean Cultivation." *Pakistan Journal Science Research*, XXXI (12) (1979), 34-40.

Srwastuva, U.K. and Das, V.M. Economics of Sunflower Production and Processing. Centre for Management of Agriculture, Indian Institute of Management, Ahmadabad, India.

UNDP, FAO. Commodity Policy Study on Oilseeds, Edible Oils, Oilseed Cakes and Meals, Pakistan. Rome, 1975.

Usman, Mohammad. Feasibility of Soybeans Spring Crop in Punjab. Agro Resources Ltd., Arbor Acres Pakistan, Ltd., Islamabad.

Zaheer, Shakila. Vegetable Ghee Industry in the Punjab. The Punjab Board of Economic Inquiry, Lahore, 1975.

SITUATION ANALYSIS--THE SEED INDUSTRY

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Hybrid Sunflower Seed Services

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PREFACE

Oilcrop Seed Industry in Pakistan

The deficit in national production of vegetable oil in Pakistan has been given considerable study. The national agricultural production system has the strategic capacity to increase the oilseed crop considerably without reducing current levels of cereal or fiber production. This would primarily involve intercropping between current rotations of rice, cotton and wheat, with a mix of traditional and nontraditional oilseeds.

The fundamental cause of the current imbalance in national oilseed production has been the maintenance of an unrealistically low official consumer vegetable oil price. This has resulted in a noncompetitive price structure for oil crops. The pricing of vegetable oil and oilseed crops by the Government of Pakistan is a policy strategy that has been made and maintained with full knowledge of the balance of payments consequences. If this policy persists, imports of vegetable oil will continue to increase without significant relief from the nation's agricultural sector. This scenario cannot be significantly altered by any donor program without a change in vegetable oil pricing policy by the Government of Pakistan.

The following report is not a study, but a series of observations. Its purpose is an attempt to define the Pakistan seed industry and to conceptualize its future potential contribution to national agricultural development. The "future potential" is an area where donor involvement can help to shape and accelerate the contribution of this industry to domestic oilseed production.

As in any developing system, Pakistani agriculture has many components where improvement would enhance total agricultural output. One glaring weak link in the agribusiness chain is the weakness or absence of a seed production and distribution infrastructure of "seed industry."

Introduction

Pakistan possesses a national agricultural research structure, the Pakistan Agricultural Research Center (PARC), along with provincial experiment stations located in key agricultural regions. A national agricultural extension system also exists. The consensus of opinion does not rank these two organizations as strong, but they have the potential to make some contribution to national output.

The "product" of agricultural research and extension is "information." The "product" of Pakistan's economic sector is "food and fiber." Therefore, the vehicle or vehicles for converting "information" to "food" cannot be taken lightly. In successful agricultural economies, a great deal of this responsibility falls upon the seed industry where it is public sector, private sector or mixed. The reasoning is straightforward. Evaluation and release of new genetic material from the research structure must be relayed consistently to the farmer. Germplasm must arrive in a pure form of economic quantity and availability in order to produce results consistent with those predicted by the research sector. Failure causes a credibility problem between the research and production functions.

The extension system, as mentioned earlier, also produces "information." Proposed management tools and their anticipated results are predicated upon genetic purity and economic field plant populations. Failure of the latter defeats the effectiveness of the extension function for improved management. (It must be noted that the Pakistan extension system currently cannot be counted on for any key role in national agricultural development.)

The seed industry is, at its best, an intermediary germplasm delivery system, dependent upon researchers for raw material. The growing, conditioning (cleaning) and storage of seed is almost as much an art form as it is a technology. Techniques vary incredibly from crop to crop and widely within a particular seed crop, depending upon environmental constraints and available capital goods.

Seed production is generally not treated as an academic discipline. Few agricultural colleges anywhere deal with seed industry functions. Whereas agricultural research and extension are taught as professional disciplines, the potential seedsman is lost in the shuffle at the university level.

The seed industry compensates for the lack of academic preparation with on-the-job training. Skills and techniques that are probably not mentioned in any published document are passed on from seedsman to seedsman in the field and in the processing plant. The importance of hard industry experience will be reflected in recommendations made later in this report.

Seed Industry Structure--Official Sector

The Pakistan seed industry officially began in 1976 with the passage of the Pakistan Seed Law. This legislation, patterned after that of many other countries, set up an official structure for the control of crop variety introductions along with specifications and procedures for the production of certified seed. Before 1976, official seed involvement was fragmented and weak.

The official sector is currently supervised by the National Seed Council. It has representatives from PARC, the Punjab Seed Corporation (public), the Sind Seed Corporation (public) and ministerial representation from the provinces. Beneath the National Seed Council are two organizations--the Seed Registration Council and the Seed Certification Service.

The Seed Registration Council functions as the authorizing organ for new varieties in Pakistan. It is heavily represented by PARC, which is chartered to test and evaluate submitted varieties for three years within the provincial experiment station system. Upon completion of these tests, data submitted to the Seed Registration Council is the basis for authorizing the release and production of a new variety.

The Seed Certification Service is mandated to conduct field inspections on seed production under application for certification or registration. It works under established quality specifications for isolation, purity and germination. Nine regional seed laboratories perform specification analyses.

This entire bureaucratic structure has been described on paper for some time. It appears there has been some recent funding support for the Seed Certification Service, perhaps by the World Bank. In any event, this agency has the future potential of increased activity if it has the proper leadership.

Within the current official seed structure the key man is Dr. Imtizaj Hussein. Both the Punjab and Sind Seed Corporations report to him. He is in charge of the Seed Certification Service and sits on the Seed Registration Council and the National Seed Council.

Seed Industry Structure--Private Sector

The private sector of the Pakistani seed industry is in its infancy. There are four or five seed companies in the country. Not one of them possesses a legitimate seed conditioning plant. To say that the private sector of the Pakistani seed industry has little impact on the nation's agriculture at this point would be correct. On the other hand, pieces of this industry will soon be in rapid transition. The following examples point out what is quietly happening.

Case Study: Rafhan Maize Products Co., Ltd.

This Faisalabad-based organization processes and markets a variety of corn-based products, including starch, fructose and oil. Raw material is obtained through corn growing contracts made through a series of commission agents. Quality is assured through a proprietary hybrid seed corn program which supplies 400 tons of double-cross corn seed to the company's contract growers.

The corn hybrids are developed and produced in Multan and the Swat Valley. A parallel corn breeding program draws experimental lines from all over the world. Dr. Khan Bahadur heads up the breeding and seed production programs. Facilities are poor, but they are doing a lot with very little.

Corn Products Company (U.S.) owns 41 percent of Rafhan. Ciba-Geigy, which markets pesticides in Pakistan and worldwide, owns Funk's Seed Company of Illinois (hybrid corn, sorghum, and sunflowers). A joint venture between Rafhan and Ciba-Geigy will shortly produce a new Pakistani seed company. Basically, it will be a marriage between Rafhan's marketing and seed production experience and Funk's multi-crop germplasm inventory. The project will involve a new seed conditioning plant.

The new corn seed company will go after the 70 percent of the 1.6 million acres of corn that is not being serviced by synthetic hybrids. Rafhan charges twice the price of "synthetics" for its double-cross corn hybrids and cannot keep up with demand. Once the new corn joint venture is in place, the company will add on hybrid forage, sorghum and hybrid sunflower seed product lines. Funk sunflower parental lines will be evaluated this year. Dr. Badahur reports that growers are paying 40 to 50 rupees per kilogram for imported hybrid sunflower seed that quickly looses its germination.

Pakistan Agro Forestry Corp., Ltd. supplies seed treatments (100 gram packages) that are placed in each seed bag.

Case Study: Pakistan Seed Company

This organization was formed in 1976 by an ex-director of the Ghee Corporation, Dr. Rahim Chaudhry. Headquartered in Lahore, it is an importing rather than a production company. It is currently importing hybrid sunflower seed from Pacific Seeds (Australian-based subsidiary of Continental Grain), Interstate Seed Co. (the number two hybrid sunflower seed company in the U.S.) and Northrup King (a Minneapolis-based subsidiary of Sandoz).

This company is working closely with the Ghee Corporation's sunflower program. This year, Pakistan Seed Company will produce the first sizeable (100 acres) hybrid sunflower seed production in the history of Pakistan. They will produce a single-cross, 894. This hybrid was released in 1973 by Drs. Gary Fick and Dave Zimmer, USDA, Fargo. It was the cornerstone on which the growth of the U.S. hybrid sunflower industry was built. It is still a popular hybrid in the tri-state area and in other countries. It exhibits a very high degree of self-compatibility. The Ghee Corporation has committed itself to buying all of the 100 acres of seed production.

The Pakistan Seed Corporation, in cooperation with the Ghee Corporation, formed the Pakistan Sunflower Association six months ago. The purpose of this organization is to promote sunflowers in Pakistan and disseminate seed and technical information to its grower members. The Pakistan Seed Corporation is also involved in the importation of vegetable seed. They are currently working with Yates Seed Company (Australia) on the possibility of developing hybrid sorghum seed production in Pakistan. They are also looking at the new double-zero rapeseed varieties.

Seed Industry Structure--Public Sector

The public sector of the Pakistan seed industry was basically formed by the Seed Act of 1976 and about $26 million dollars in World Bank funds. This bought four big state-of-the-art seed conditioning plants. Three were located in Punjab to form the Punjab Seed Corporation. Sind Province complained, so it got one plant and the Sind Seed Corporation was formed.

The plants were due to be operational in 1980, but the Sind Seed Corporation facility (Sakrand) has just started up and Khanewal (Punjab) is scheduled to begin operations in June 1983. Rahimyar Khan (sister plant to Khanewal) should start up shortly after. Sahiwal (Punjab) is a problem and poor structural engineering has created a legal battle. Management at all plants is short on experience. The plants are high volume, so there will be no such thing as a small mistake. The two public seed corporations report to Dr. Imitzaj Hussein. (See, "Seed Industry Structure--Official Sector.")

Annual Seed Conditioning Capacity
(Maximum Production under Optimum Management)

	Metric Tons
Wheat Seed:	
Khanewal (Punjab)	60,000
Rahimyar Khan (Punjab)	60,000
Sahiwal (Punjab)	26,000
Sakrand (Sind)	26,000
Total	172,000
Annual Use Capacity	600,000
Percent Annual Use	29
Cotton Seed:	
Khanewal (Punjab)	14,000
Rahimyar Khan (Punjab)	14,000
Sakrand (Sind)	14,000
Total	42,000
Annual Use Capacity	54,000
Percent Annual Use	78
Corn Seed (tm):	
Sahiwal (Punjab)	15,000
Total	15,000
Annual Use Capacity	16,000
Percent Annual Use	94

Kanewal wants to get into hybrid sunflower seed production. Sakrand has programmed rice and rapeseed into their program as well. These plants have all been constructed in hot areas. Drying facilities may not be adequate and germination could be a nagging problem. Despite all of this, there will be a contribution to Pakistani agriculture, and it will be sizeable. These four seed processing facilities are a step into the 20th century seed industry.

Romanian Sunflower Seed Connection

In a few months Romanian technicians will arrive at the Khanewal facility of Punjab Seed Corporation to begin a hybrid sunflower seed program. There is talk that an additional 2,000 acres of seed farm land will be added to support the sunflower seed production effort. There is already 4,500 acres at Khanewal. Romanian interest in Pakistan as a market for sunflower seed technology goes back over four years to when the Romanians approached the Ghee Corporation. The offer made then fell through because of the high price of seed (double the U.S.) and several "strings" involving equipment purchases.

It is too early to evaluate the potential contribution of this arrangement to Pakistan's vegetable oil production. It is also too early to tell what impact it will have on private sector projects to produce hybrid sunflower seed. Romania tried to penetrate the emerging U.S. hybrid sunflower seed industry in 1974. Rom Sun 52 was their offering. It was expensive and consistently did poorly (compared with U.S. hybrids) throughout the country. That was the beginning and end of Romanian sunflower hybrids in the U.S.

The Romanian component of the Pakistan seed industry is, at this point, impossible to evaluate. As things progress, it could play an important role in developing hybrid germplasm and hybrid seed for the sunflower effort.

The Ghee Corporation Connection

If something significant changes in the domestic oilseed production picture, then the Ghee Corporation will be at the heart of it. They have the strength from any point of view--buying, processing, marketing, importation. It is just that simple.

The seedsman is traditionally subservient in his role. He gives the power structure what it wants. The power structure in oilseeds is the Ghee Corporation, and it is conducting a major promotion of sunflowers. The corporation has 77 men in the field pushing this crop. Surely, many of them are technically weak. Quantity can often overcome quality and they are using the media. The Ghee Corporation sponsors sunflower promotion programs on prime time national television.

Every potential oilseed crop for Pakistan has some drawback. Cottonseed--low in oil, with a lint and acreage limitation. Soybeans--lots of meal, not that much oil, sensitive to high temperatures and germination maintenance problems. Safflower--lots of stickers in a hand harvest system. Groundnuts--digging problems, defatting questions, crop competition and human food considerations. Rape--competition with wheat and problems with aphids, along with erucic acid. Every one of these problems has a technical solution and many are rather simple. The

environmental and cropping diversity of Pakistan should warrant a mix of all these oilseeds from a scientific standpoint.

But the real emphasis in Pakistan now is on sunflowers. The force behind this is the General Manager/Coordinator of the Seed Division, the Ghee Corporation. He has worked with sunflowers since the mid-1960's and sees them as a catch crop in rotation with cotton, wheat and rice.

There is logic behind the heavy concentration on sunflowers. With finite resources, a multi-crop oilseed program could dilute itself to a point where not that much oilseed acreage would result due to confusion and lack of priorities. This program is simple--sunflowers.

There is a rationale. The theoretical catch crop rotation acreage for sunflower is impressive. The open rice rotation land in Sind alone is over one million acres. Twenty-five percent of the nation's 15 million acres of wheat is open in the late summer/fall. That is another 3.75 million acres. One and one-half million acres of cotton land is open in the winter. That is a potential production of over six million acres of sunflower without reducing current cereal and fiber acreage at all. The U.S. sunflower oilseed acreage hovers around four million.

These are number games played on paper, but the reality is there. Crop land for sunflowers exists and the Ghee Corporation is starting to move in that direction. The GCP is reporting 1,000 to 2,000 pounds per acre yields in various rotations from diverse production locations. With marginal management practices these may not be accurate numbers as "average" yields, but a catch crop is a cash crop. It helps cash flow on the main line cereal or fiber production costs. Sunflower input costs are low. Break even is probably around 600 rupees per acre or less. Six hundred to 1,200 lb/acre yields could be consistently expected. The numbers are there.

Take six million acres of sunflowers with 700 lb/acre production at 30 percent recovered oil and you have 630,000 short tons of oil. There goes the production deficit. Could Pakistan process it all? That is a good question. What would they do with all that high fiber, high oil cake?

What about solvent extraction? Low quality cake is the pivotal problem. The Pakistanis do not have an answer. Probably the only logical solution would be a low cake price to stimulate usage for livestock. Winter forage availability is tight. However, the selling price of sunflower oil would have to compensate for the discount on the oil cake side. This could trigger solvent extraction. In any event, these are the "hard" decisions that the Ghee Corporation will inevitably have to make if production of any oilseed sharply increases.

One interesting observation is that the Ghee Coporation has programmed 73,000 acres of sunflowers for this spring. They have

imported $320,000 worth, or Rs 4.16 million, of American and Australian hybrid sunflower seed for the program.

Seed Status--Sunflower

Low populations of bees in different parts of Pakistan have doomed open-pollinated varieties because of their inherent low, self-compatibility. Hybrids generally possess a high degree of self-compatibility and are the only reliable seed solution possible. Three hybrids have been successfully tested at the provincial station level. They are Interstate 894, Northrup King 212, and Hy Sun 31. Two of the hybrids are of U.S. origin; Hy Sun 31 is from Australia.

The Ghee Corporation has imported over 70 tons of hybrid sunflower planting seed for this season. Pakistan Seed Corporation will commence hybrid seed production this year. The Romanians are coming. In a few years, the hybrid sunflower seed business in Pakistan could be wide open and loose. If sunflowers take off as a crop, the seed side could be exciting.

Bees and seed storage are the only two problems seen for Pakistani-based hybrid seed production. The Swat Valley has both solutions.

Because of low seeding rates (1.5 to 2 kg/acre) this seed crop is not that freight sensitive and could be moved around to hold germination.

It is significant that the Ghee Corporation and Punjab Seed Corporation are moving to hybrids.

Government of Pakistan (GOP) research must not inhibit this movement by promoting open-pollinated varieties. For once, Pakistan has an opportunity to adopt technologies similar to the developed agricultural economies. If open-pollinated varieties and hybrids are promoted, the confusion and frustration at the grower level will be disastrous.

Donor countries should not sponsor either directly or indirectly any research program in Pakistan that promotes or develops open-pollinated sunflower varieties. The world's sunflower-producing countries have moved to hybrids. Russia, the last bastion of open-pollinated sunflower seed, is quietly buying hybrid sunflower seed stocks from the U.S.

Open-pollinated varieties have more problems than just self-compatibility. They inherently lack uniformity in height and flower over a longer period of time. Height variability is purely cosmetic and is not a real factor because of the hand harvesting in Pakistan. The extended duration in flowering with open-pollinated varieties presents some more serious problems.

The longer flowering period translates into an uneven maturity situation. This effectively lengthens the actual production time by as much as two to three weeks (depending upon environmental conditions).

Since sunflowers will always be placed in a continuous rotation, the open-pollinated varieties unnecessarily put time pressure on harvesting and land preparation for the following crop. This extended maturation period also exposes the crop to increased danger from parrot attack. Bird damage is to be expected in all production areas. The only solution will be to increase acreage in a given area in order to distribute the damage.

Seed Status--Soybeans

It looks as though soybean seed will be in the private sector by default. There is no public sector interest in soybeans, but they may get involved later on down the road. Williams is "the" variety to date in Pakistan. Seed needs to be produced and stored in the Swat Valley. Germination is the only production problem from a seed standpoint. The private sector will need some donor help here. The soybean seed business in Pakistan does not really exist yet.

Lower Sind has logistical difficulties because of its distance from potential Swat Valley production areas. Work has been done at Tandojam that suggests local production (and storage) possibilities with some small-seeded Taiwanese varieties. This should be investigated further.

Soybeans have their strongest potential role in the Punjab. Their economics from a seed standpoint is similar to wheat: low value per unit, large quantity per acre seeding rate. This makes soybean seed somewaht freight sensitive. The problem is that soybean production areas in Punjab get "hot." For germination protection, the seed either must be produced nearby in cooler areas or produced in the local use area, shipped out and then shipped back. Freight strategy for germination preservation is a consideration in soybean seed planning. Moving soybean seed from Swat to Multan would increase seed costs by about 15 to 25 rupees per acre.

Soybean seed transportation has not really surfaced as an issue at this point. When 100,000 acres of soybean production are considered, then seed logistics and freight bills become something to be dealt with directly. Taiwanese varieties would offer some less expensive alternatives.

Seed Status--Rape

Rapeseed is strictly an irregular market product. There is no serious public or private sector seed activity built around this crop. Stands are marginal everywhere, but it not known if it is due to poor germination, sowing practices or both.

The Canadians are in Pakistan and will most likely introduce double zero varieties of rapeseed on a large scale. As these new varieties flow out of the research pipeline, their genetic purity is going to be difficult to maintain because of continual out-crossing with local varieties. This means that erucic acid levels will be reduced slowly in the rapeseed crop year after year. There will not be a rapid elimination of erucic acid.

Seed certification specifications for rape do not, at present, exist in Pakistan. No mention of any rapeseed plans from either the Punjab or Sind Seed Corporations has been heard.

Production locations probably should be centered in the NWFP. Any seed production program located in this Province would have to work closely with the Canadian program. Potential donors should do nothing in this seed area without further study and discussions with the Canadians.

Varietal developments in rape and mustard could have local impact. Nationally, these crops are not going to be a major share of vegetable oil production. Politically, there does not seem to be that kind of interest from any quarter.

The best oilcrop researcher in Pakistan--and good by any nation's standards--is Dr. Altaf Hussain Chaudhry. He has a rape and mustard program that will shortly produce some interesting new varieties in Sind. It is interesting to note that the new Sind Seed Corporation plant at Sakrand (currently operational) plans to begin processing rapeseed this year.

Seed Status--Groundnuts

Groundnuts are a highly speculative oilseed crop. The Pakistanis relate to them as food. The Indians use them as a major oilcrop. Within the scope of established oilcrops, groundnuts have the greatest potential.

Stands of groundnuts are poor, digging costs often consume half the crop and they are expensive by comparison. The latter factor discourages the vegetable oil people.

The seed distribution system is irregular and without a public or private sector infrastructure. Production economics can be improved (cheaper costs) with better stands and some kind of a bullock-powered digger. The seed situation must improve before anything is going to change in groundnuts.

There might be a good case for some special donor barani assistance, except for the fact that the Canadians (Barani Project) may be handling groundnuts. If they are, the full extent of their program must be defined and discussions held. The seed component for groundnuts must be evaluated further and the Canadians should be involved in any seed planning.

The Swat Valley Connection

As the seed situation in Pakistan is considered so is the Swat Valley. The Valley's major problem is its location. The freight situation will always have to be backed into any seed cost planning for that part of the NWFP. If lower Sind is serviced with Swat hybrid sunflower seed production, a long freight haul is faced. Then why Swat? It has certain assets that are looked for in seed production.

1. It has a bee industry. Reliable, quality bee activity in cross pollination is critical for hybrid sunflower seed production.

2. It is near high elevation (4,000 to 5,000 feet) storage locations. This insures high germination.

3. The temperatures are milder than other agricultural production areas, so there is better seed set.

4. It is scattered enough to provide seed production field isolation.

5. There is excellent oilseed leadership at the Mingora Station through the efforts of Mr. Abdul Qadeem.

6. Not far from the Mingora Station is a brand new refrigerated warehouse. This would be excellent for storing expensive seed stocks.

The U.S. seed industry learned earlier that it is much easier and cheaper to pay a trucker than to fight "Mother Nature." Seed crops are concentrated in regions because of environmental advantages in the U.S.

There may be other areas for oilcrop seed production in Pakistan that are better located for servicing the growing areas. If there are, they will surface in time through trial and error. However, at this early stage, Swat appears to be the safest haven for oilcrop seed production (hybrid sunflowers and soybeans).

Summary and Proposals

Within the next five years a legitimate seed industry infrastructure can develop in Pakistan. Many components already exist. Organizations need to grow and stabilize. This is true of both the private and public sectors. The dearth of qualified people in skilled positions for both sectors will be the limiting factor.

Nontraditional oilcrop seed production is particularly weak. A reliable supply of quality, domestically-produced seeds is crucial to the increase of oilcrop acreage in Pakistan. A three-pronged, three-year attack on the situation is proposed:

1. **Oilcrop Seed Project.** This is a program involving donor-country commercial oilcrop seed specialists, Pakistani counterparts and small-scale seed cleaners. Its purpose is to train seedsmen and stimulate private sector involvement in oilcrop seed production and distribution.

2. **Ghee Corporation Assistance Program.** This involves a sunflower production specialist assigned to the Ghee Corporation to broaden their thin, field staff management. It also funds field transportation and thresher capabilities.

3. **Donor-sponsored Hybrid Sunflower Plant Breeder.** A research effort is not within the formal scope of this report but should be addresssed.

Costs for the first two projects would total somewhat over $2,000,000 for three years.

Oilcrop Seed Project

Commercial Seedsmen Proposal

1 Expatriate commercial seedsman with production and processing experience in hybrid sunflower planting seed (critical) and experience with wheat and other crops

desirable. A vehicle and two Pakistani B.S. agronomist counterparts (three years) would be needed.

1 Expatriate commercial seedsmen with production and processing experience in soybean and hybrid corn planting seed. A vehicle and two Pakistani B.S. agronomist counterparts (three years) would be needed.

Expatriate Seed Production Personnel

The seedsmen required for this program must be actively involved in the private sector. Commercial seedsmen in the U.S., for example, do not get their expertise from textbooks--they cannot. The men for this job must have had hands-on experience in production and processing. Management experience and some stature in the industry are also very important. Seedsmen with pure sales experience will be worthless. Multi-crop expertise would be invaluable.

The U.S. seed industry is currently in a severe recession and there should be opportunities to find people. But international experience is going to be almost impossible to get along with the other qualifications.

Neither the expatriate seedsmen nor their counterparts should be assigned to a Pakistan government agency. This is not to say that these people should be restricted in any way from helping government seed corporations or agencies. The government has the principal seed production capability. The objective is a better seed industry for Pakistan.

It cannot be emphasized enough that these individuals must have "hard" experience. Failure to meet this requirement would cripple an oilcrop seed project.

Pakistani Seed Production Counterparts

The four Pakistani counterparts on the oilcrop seed project are to be the core technical seed management personnel which Pakistan so desperately needs. Four people are certainly not enough, but the expatriate seedsmen will be training others as part of their responsibilities.

Oilcrop Seed Project

Consultant Proposal

1. Provide a catalyst for Pakistani private sector seed activity and investment.

2. Provide technical advice in oilcrop seed production, processing and storage to all interested public and private organizations.

3. Work closely with the Ghee Corporation on seed logistics.

4. Distribute small seed cleaners, along with appropriate training, to strategic potential oilseed industry participants. The purpose is to increase the number of people in seed activities and spread the activity over a wider geographic area.

5. Act as a liaison with the expatriate seed industry concerning potential joint venture or licensing opportunities.

Material Proposal

30 M3B type, small seed cleaners (Seedboro), complete with hopper, elevator, sack-off unit, full set of sizing screens and treater (if possible). Approximately $18,000 each F.O.B. plant. (220 V, 50 cycle)

30 Electric sewing bag closers with thread. Check thread availability and service in Pakistan. Approximately $400 each. (220 V, 50 cycle)

Small Seed Cleaner Program Proposal

The M3B type unit is a small, simple self-contained seed cleaning plant. It requires no installation. It should be able to handle about four tons of sunflower seed or about eight tons of soybean seed in an eight-hour day. Enough soybean planting seed to sow around 18,000 acres could be cleaned with one of these units in about 100 days. Considering the flexibility of the machine and the way Pakistanis utilize scarce capital goods, the output of one of these cleaners could be quite impressive in the right hands.

Proper management is the key. Seed shortages are commonplace. With the very large plants of the Punjab and Sind Seed Corporations, it is doubtful, even with proper management, that these organizations can handle 20 percent of the wheat seed sector. "Efficient" management of these sophisticated plants also raises some doubt. The centralized processing plant concept is predicated upon efficient transportation, regionalized storage and effective distribution infrastructures. These do not exist now in Pakistan.

Poor seed planning will penalize outlying agricultural areas the most. They are the ones with the greatest need for good seed.

Most important, the two big government seed organizations are not going to touch soybean seed, and with good reason--maintaining seed with viable germination. Filling that gap cannot be left to hope but must be handled head-on.

A half a million dollars in equipment is not going to turn around a nation's seed industry. The concept that is needed is regionalized placement of small cleaners working for a catalytic effect. Get more people get involved in this activity and then they will have an "industry."

Placing the units in the right hands is obviously critical. It must be done carefully by a responsible donor acting on the studied recommendations of expatriate commercial seedsman in the field. Who would be likely candidates? There are several: Pakistani businessmen, small seed companies, large progressive farmers, aggressive provincial experiment stations and grower cooperatives. There is not a definite answer. A commercial seedsman has to live in Pakistan, learn the country's seed marketing system and then take steps. The financial arrangements would have to be loose--soft loan, outright gift--whatever fits.

Six distinct organizations (one public) were encountered that could make excellent use of an M38 unit in oilcrop seed production. The surface of the seed infrastructure of Pakistan has been less than skimmed, but the placement of 30 units here would, by no means, be difficult. Seedburo markets the M38 which means that it has a representative in Pakistan. This would help in obtaining spare parts.

Ghee Corporation Assistance Program (Three Years)

The Ghee Corporation sunflower promotion program is in place, but staff technical quality is highly variable and field transportation is limiting. Thresher availability is critically short and available machines are technically wanting.

<u>Proposal</u>

A. One expatriate sunflower production specialist to aid the GCP in upgrading the promotional and technical capabilities of sunflower field staff. He would aid the staff in field demonstrations, farmer relations and work with the expatriate and Pakistani researchers. This individual would need sunflower experience, but not necessarily a Ph.D. Marketing experience would be helpful. He would be assigned to the Ghee Corporation for three years and would report to the General Manager/Coordinator of the Seed Division.

B. Provide the Ghee Corporation and Multan-based thresher manufacturers with development money for modifying the current

locally produced sunflower thresher to handle sunflowers, soybeans and safflower. This is basically just a switch to a rasp bar cylinder. All expatriate oilseed development personnel (research, seed production and crop production) would be involved.

C. Purchase 200 of the new thresher units for the Ghee Corporation. These would be loaned to farmers to demonstrate the advantages of mechanization in threshing nontraditional oilseeds. Approximate per unit cost is 12,000 rupees.

D. Provide the Ghee Corporation with 15 four-wheel, right-hand drive vehicles for the oilseed promotion field staff.

E. Develop and print bilingual oilcrop production literature on sunflower, safflower, soybean, rape and peanut (with color photographs using expatriate team efforts).

Oilcrop Seed Project Proposal and Ghee Corporation Assistance Program Proposal

People (3 expatriate specialists, 3 vehicles)	$1,080,000
People (4 Pakistani counterparts)	
Material	979,000
	$2,059,000

Note 1: A summer seed internship program for a few key Pakistanis with some interested international seed companies should be investigated. The mutual benefits are obvious. The cost would be reasonable.

Note 2: The Pakistan Government's oilseed research effort is probably inadequate. The strategic placement of expatriate oilseed scientists within the Pakistani research establishment, with independent funding, would be of great value to oilcrop development in Pakistan.

An expatriate sunflower plant breeder working with Dr. Altaf Hussain Chaudhry, would greatly reinforce the effectiveness of an oilcrop seed project and the Ghee Corporation assistance program.

Conclusion

Things are quietly and steadily happening in Pakistani agriculture, although they will not be seen at the agricultural colleges nor at most government agricultural research facilities. Insecticide use on cotton is at 10 percent and growing. There are more tractors and more tillage equipment in the field. The use of locally manufactured stationary threshers and grain drills is increasing. The rate of technological development varies directly with the size of land holdings.

The greater Multan area is and will continue to be the pacesetter for Pakistani agricultural development. Oilseeds will follow this pattern.

The public and private sectors of the seed industry are on the verge of a growth period. They are moving on separate but parallel paths. Each has a role and there is room for both in Pakistan. The healthy development of private and governmental seed organizations is critical for further food and fiber gains in the country.

The biggest present constraint on both public and private seed sectors is the availability of qualified people. This problem will severely affect the development of nontraditional oilcrops in Pakistan if it is not addressed.

Establishment of new crops requires either abnormally high prices or abnormally hard work. If there are both, it is abnormally fortunate.

INTEGRATED ECONOMIC RESEARCH ON EDIBLE OILSEED PRODUCTION IN PAKISTAN

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February, 1983

Summary and Recommendations

There are limited amounts of data available at research stations and universities on yields resulting when the inputs are varied--primarily fertilizer and seed. Varietal tests are also underway to determine which varieties give the best results under varying ecological conditions, including variations in soil, water and temperature.

There has been little serious economic analysis of the available data on oilseed crops. For example, several cost and return studies on traditional crops were done on farmers' fields by the University of Agriculture, Faisalabad. These studies include soybeans, groundnuts and rape and mustard, but they have not been analyzed. Another instance where data were gathered but not analyzed is a cost and return study on soybeans on a farm in the Rawalpindi District.

Economic analysis of available data at the farm level to determine the optimum economic level of inputs is almost totally lacking. Such analyses should be undertaken. Data should also be gathered and analyzed on the effect on costs and returns of crop rotations on dobari, cotton-fallow, kacha and rainfed barani lands for different oilseeds with varying levels of inputs for each crop.

Farm income should be calculated on the basis of the entire farm to determine the optimum use of fixed and variable inputs. This is a complex problem that requires the expertise of a competent production economist and computer programmer. The basic data need to be developed, assimilated and then programmed into a computer model to determine the optimum combination of inputs when variables in the data are changed. Once the data are assembled and put into the computer, they can be manipulated to obtain answers to a multitude of production economic questions. The economic impact of adding oilseeds to traditional crop rotations can then be examined.

Large acreages of rice-fallow, cotton-fallow, kacha and rainfed lands are available for traditional and nontraditional oilseed production. An estimated 2.5 million acres of fallow land after rice and cotton, 4.5 million acres of kacha land (riverine) and 6.5 million acres of rainfed lands could be devoted to nontraditional oilseed production. Assuming that only 50 percent of this acreage were used for nontraditional oilseeds, that would amount to 6.75 million acres. These crops would supplant no other crop, but they would be an added crop grown on fallow and otherwise unused land. Because the farmer would be adding few inputs and spreading his fixed costs over an additional crop, thus lowering his annual cost per unit on all crops, much of the gross income would be net income.

A major consideration is that new oilseed crops fit into existing cropping patterns without supplanting any of the major crops:

wheat, rice, cotton and sugarcane. This could be done by planting existing cropland which lies fallow during both the kharif and rabi cropping seasons (Figures 1, 2 and 3). Thus, oilseeds become an economically attractive addition to the existing cropping patterns.

Several oilseed crops are grown commercially in the present cropping system. These are the traditional edible oilseed crops: rape and mustard, groundnut and sesame. Soybeans, sunflower and safflower are identified as nontraditional oilseed crops. Suitable cropping patterns are identified for these and are shown in Figures 1, 2 and 3.* These new oilseed crops must fit into existing cropping patterns if they are to be viable alternatives in Pakistani agriculture.

The figures on the next page show how oilseeds fit into a crop rotation without disrupting production of any of the traditional crops. The income of the farmer is increased by adding a crop during a period when the land would otherwise lie fallow. This practice reduces per unit costs of production while increasing returns.

It is most important that the farmer follow recommended practices for production of oilseed crops on the fallow land. If he does not, he will fall far short of realizing full return from his land and other production inputs. This cropping pattern meets the dual needs of increasing the national edible oilseed production and the income for farmers, particularly small farmers.

Yields on experimental plots and those obtained by progressive farmers show that traditional oilseed yields can be doubled and tripled by adding more fertilizer and seed. At what point the addition of fertilizer and seed reaches the point of maximum net return is not known. This needs to be determined.

Comparative returns from nontraditional oilseed crops and the major crops cannot be made at this time because farmers are not attempting to maximize returns from them. Instead, they are cropping the land to fill a gap in a cropping system with as low an input level as possible. A comparative return per acre on present yields of selected crops is shown in Table 1. This shows the gross returns from traditional oilseed crops to be low compared to other crops.

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*Source of Figures 1, 2 and 3 is "Perspectives of Edible Oil Research and Production in Pakistan," Amir Ahmad and A. Rahman Khan. Pakistan Agricultural Research Council, 1981.

Figure 1.

Desirable Crop Rotation for Soybeans

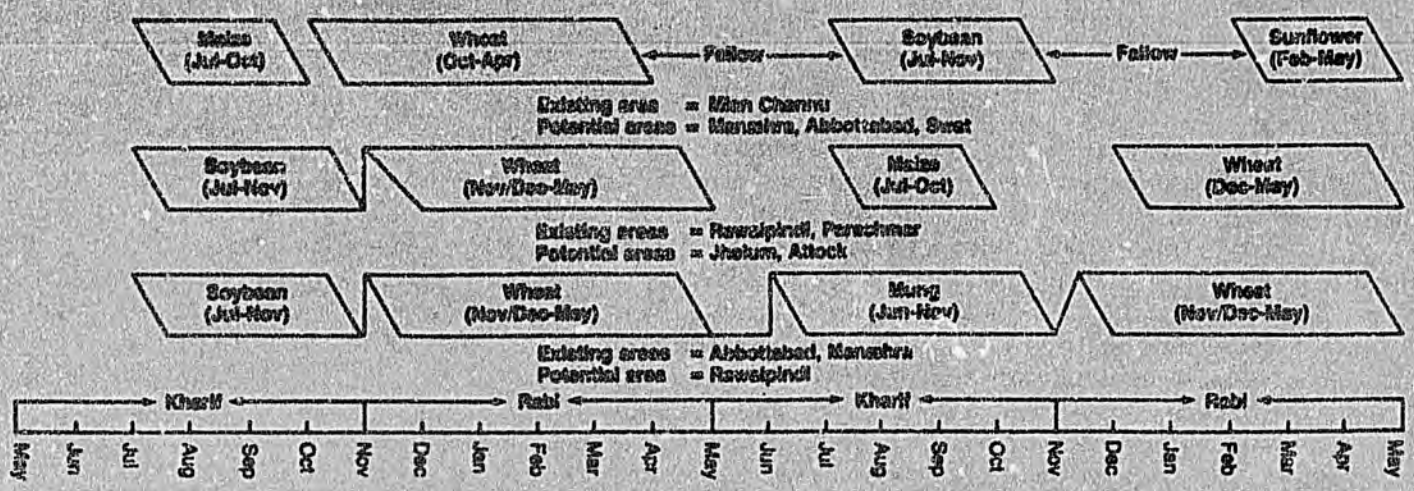

Figure 2

Desirable Crop Rotation for Sunflower

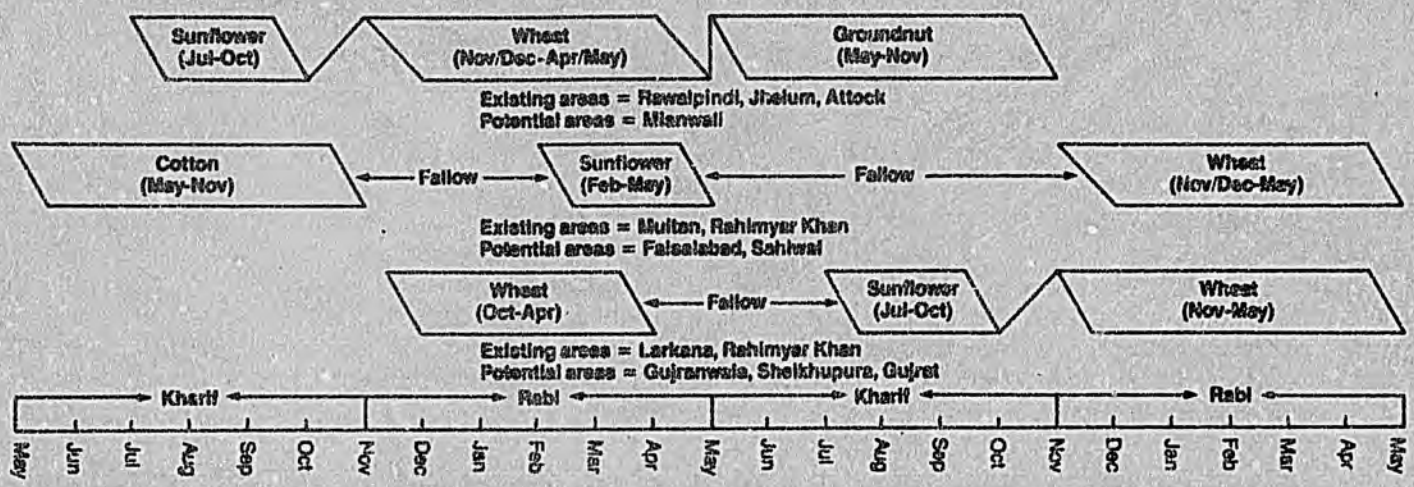

Figure 3

Desirable Crop Rotation for Safflower

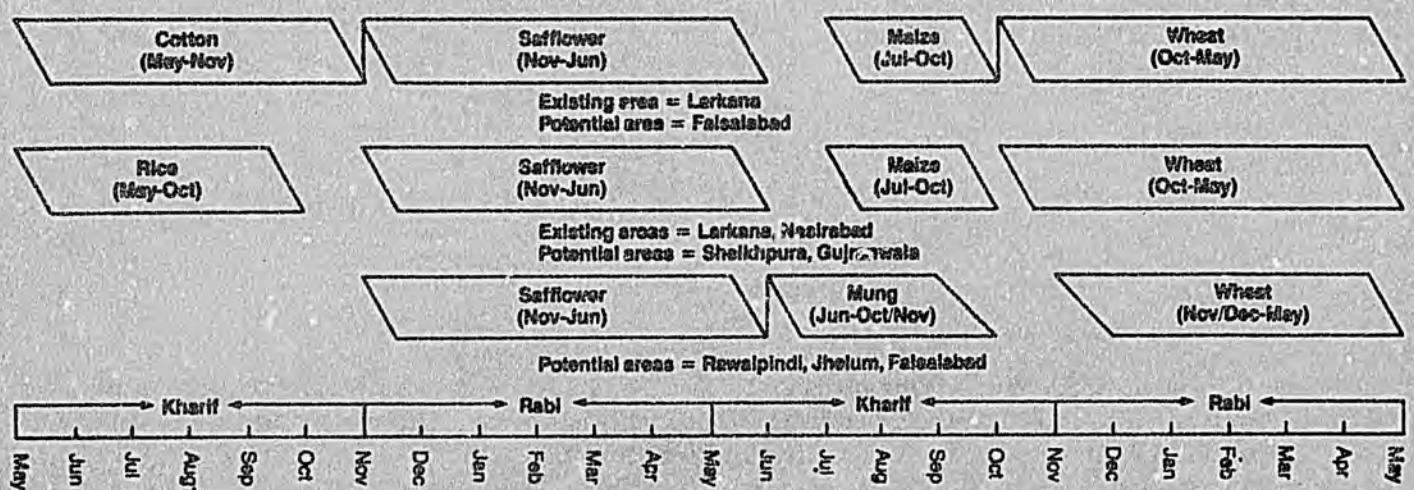

Table 1

Net Returns per Acre on Medium-Sized Farms in Pakistan
Based on 1980-81 Average Yields and Present Prices

Crop	Yield[a]	Price[b,c]	On-Farm Gross Return Per Acre	Production Costs Per Acre	Net Return Per Acre
Sugarcane	676.0	10.5	4,996	4,517	481
Wheat (irrigated)	16.4	190.0	3,116	1,730	1,386
Wheat (Barani)	6.0	190.0	1,140		
Cotton	12.0	205.0	2,460	1,073	1,387
Rice	18.0	405.0 (superior)	8,100	1,774	6,326
		180.0 (inferior)	3,240	1,774	1,466
Maize	15.0	105.0	1,575	1,483	92
Mustard and Rape	6.0	410.0	2,460	205	2,255
Sunflower	7.0	144.0	980	120	860
Safflower	6.0	120.0	720	120	600
Soybeans	7.5	122.0	915	220	695
Groundnut	12.0	210.0 (in shell)	2,520	1,595	925

[a]Prices taken from The Muslim newspaper, February 4, 1983, p. 7, and government support prices used for nontraditional oilseed, sunflower, safflower and soybeans.

[b]Yields taken from Agricultural Statistics of Pakistan, 1981, Ministry of Food, Agriculture & Cooperatives, Food and Agriculture Division and estimates by farmers and knowledgeable persons from all over Pakistan.

[c]Price of sugarcane taken from Pakistan Economic Survey, 1980-81, and adjusted for inflation at the rate of eight percent per annum.

*Prices and yields are measured in maunds equal to 40 kg.

There is a need for continuous on-farm economic research on nontraditional oilseed production. This would help determine costs and returns to the input costs, including both labor and purchased inputs. Methods should be developed to compute costs of capital goods, land and other fixed assets used in production. A list of the costs which may be incurred appears in Table 2. A thorough anlysis of these data will reveal to farmers the economic effect of different oilseed crops on their net farm income. This data will also be valuable to policy makers in establishing farm prices.

Sufficient fertilizer will apparently be available for producing nontraditional oilseed crops in the immediate future. Knowledgeable persons close to Pakistani agriculture expressed this opinion.

Table 2

Items to Include in Tabulating Cost Per Acre of Production and Income for Oilseed Crops

Costs of Production	Irrigated	Non-Irrigated
Preparatory Tillage		
Plowing	_____	_____
Planing	_____	_____
Leveling	_____	_____
Seedbed Preparation		
Plowing	_____	_____
Planking	_____	_____
Sowing	_____	_____
Cultivation (interculture)	_____	_____
Cost of Fertilizer	_____	_____
Fertilizer Application (laborers)	_____	_____
Cost of Seed	_____	_____
Cost of Farmyard Manure	_____	_____
Water	_____	_____
Taxes	_____	_____
Bund Building Charges	_____	_____
Irrigation	_____	_____
Plant Protection	_____	_____
Implements	_____	_____
Harvesting	_____	_____
Threshing, Winnowing, Bagging, Hauling	_____	_____
Hired Labor	_____	_____
Rent of Land	_____	_____
	_____	_____
TOTAL Cost/Acre	_____	_____
Income	**Irrigated**	**Non-Irrigated**
Crop Income	_____	_____
By-Product Value	_____	_____
TOTAL Income/Acre	_____	_____

The growth in use of fertilizer on nontraditional oilseed crops and rape and mustard could be sizable over the next few years, assuming that farmers have incentives to apply increased fertilizer. The rough estimate of added fertilizer requirements for oilseeds is 650,000 metric tons divided about equally between ammonium phosphate and ammonium nitrate.

The private sector is already producing a significant portion of the fertilizer Pakistan requires. The Pakistan Government should work closely with the private sector to provide incentives for producing adequate supplies of fertilizer.

Seed to produce the oilseed crops on the anticipated available acres is estimated at 52,000 metric tons. The acreage required to produce this seed, assuming fair yields, is 44,720 acres for all three crops: sunflower, safflower and soybeans. Presently, there is little, if any, seed from indigenous sources, but production and handling of quality seed in Pakistan will likely fill the gap in two to three years. In the interim, imports are necessary. The private sector should be given government concessions and credit incentives to encourage them to produce, process and market quality seed in Pakistan.

Pesticides have been used sparingly on traditional oilseed crops. Farmers accept the average low yield and expend as little as possible on inputs for these crops. This is likely to continue until farmers learn that income from these crops can be enhanced sufficiently to warrant risking additional expenditures for fertilizer and pesticides. If this occurs, pesticide shortages may be anticipated, so steps should be taken to identify the pesticides required and sources of supply.

Machinery for adequate land preparation is noticeably lacking, especially for dobari land. The lack of suitable tillage equipment results in very rough seedbed preparation and a low germination rate because seeds are covered at varying depth, if at all. Uneven stands result. Design and adoption of a more suitable tillage tool for bullock and tractor draft could improve yields by at least 20 percent. The tool should be designed to be small enough to be drawn by a pair of bullocks and be affordable to farmers with 12.5 acres or less on a purchase or rental basis. Encouraging local manufacturers to design and build a suitable tillage implement should be a part of the Government of Pakistan's (GOP) policy.

A small bullock-drawn seeder is another implement urgently needed to make oilseed crops more economically viable. This piece of equipment would enable a more even distribution of seed at recommended depths. It would improve control of plant population and increase yield per acre. The GOP should offer incentives to local equipment manufacturers in the form of lower interest rates, tax breaks and promotion assistance for manufacturing and marketing such seeders. The seeder should be bullock-drawn, suitable for small acreages and affordable to small farmers. An alternative would be to encourage private entrepreneurs to develop a custom service business which would provide the equipment and perform the service at a fixed rate per acre.

Mechanical threshers adaptable for use on several crops, including oilseeds, are needed. The limited time between harvest and re-seeding in closely scheduled crop rotations such as those visualized with nontraditional oilseeds, can cause problems when present threshing methods are used. Failure to get the oilseed crop in early enough may delay the next crop and result in a decline in yield of one of the major crops. This could impede developing a program for increasing edible oilseed production. Introducing small threshers would also cut threshing costs by reducing the seed loss and quality decline caused by traditional methods. From an economic viewpoint, a thresher could easily pay for itself in a relatively short time.

Several threshers, seeders and tillers marketed in Pakistan were observed at Kahniwal and Sahiwal near Multan. They appear to be too costly for the small farmer. A simpler, hand-operated thresher or bullock-drawn tillage implement should be designed and built by local business with government support. There is a real opportunity for enterprising private business in Pakistan to develop hire services and equipment for tillage and threshing. Such businesses would probably thrive in many vilages and could be encouraged by the government.

How the Study was Conducted

The information on completed and ongoing oilseed research in Pakistan came from a review of reports by the Pakistan Government, international agricultural research institutions, the World Bank, FAO, USDA and USAID. Much information was also garnered during a 21-day tour visiting persons at research institutions, agricultural universities and government agencies involved in oilseed research and promotion. During this tour, visits were also made to private oilseed processors, farm equipment manufacturers, oilseed quality laboratories, government oilseed processing mills and seed processing plants, Ghee Corporation demonstration plots and large farms producing mustard, rape, safflower and sunflower.

The major portion of the conclusions and recommendations in this paper were drawn from the discussion with people contacted on this tour. This information was examined in light of the publications, available data and additional discussions among members of the oilseed research and development team. It is slanted toward the economic analysis needed when research and development begins in Pakistan to increase production of edible oilseeds.

1. The Strong and Weak Elements of the Existing Situation

a. Major Findings

(i) Strong Points

(a) Pakistan's federal government and provincial officials are aware of the need for edible oilseed research and development and are encouraging progress in those areas.

(b) Private companies associated with edible oilseed processing and edible oil production and marketing are generally aware of the need to produce and market more oilseed. They will become involved when more profitable opportunities present themselves.

(c) In all four provinces, there is research underway on varietal testing, seeding rates, fertilizer response and cultural practices for sunflowers, safflower, rape and mustard and soybeans.

(d) A program on adaptive research on safflower and sunflower is underway in all four provinces. Some developmental seed work for rape and mustard seed and soybeans is underway in the NWFP and Baluchistan. Much of the seed development research and production promotion is being done by the Ghee Corporation of Pakistan. They are involved in safflower and sunflower crop development in Sind, Punjab and Baluchistan.

(e) There is a nucleus of dedicated and competent research workers.

(f) Vast areas for production for oilseed crops are available without disrupting the acreage of major food and fiber crops.

(g) Several studies have been done on the economics of oilseed production and marketing and the methodology is available for determining cost of production and returns at the farm level.

(h) There is an extension service in place at the provincial level.

(2) Weaknesses

(a) Research and development plans are not coordinated at the federal level and are often weak at the provincial levels.

(b) There is insufficient staffing and funding at the provincial level for the research and development needed for an expanded and economically viable production program.

(c) There are almost no usable farm level data on the cost of oilseed production.

(d) There is no plan for analyzing how oilseed production cost and return data change when inputs are varied, given the variations in costs for inputs and prices for outputs.

(e) No economic studies have been done on the economic complementarity of oilseed crops and food crops.

(f) There has been no economic analysis of the costs and benefits resulting from the use of recommended cultural practices and improved machinery, including seeders and threshers.

(g) No plan has been developed for disseminating economic information on oilseed production to farmers.

(h) Processing facilities for oilseeds are in varying degrees of repair.

2. Priority Areas for Economic Research

a. Develop plans for collecting data on farm management, including inputs/outputs and costs and returns. These data can be used to do an economic analysis of oilseed production on dobari, cotton-fallow and groundnut development areas, mainly in the barani land.

b. Analyze economic data, including costs and returns, when inputs are varied in amount or form.

c. Put information into a usable form for farmers and develop a system for disseminating it to farmers in each project area.

Proposed Project

This is a technical description, including donor and GOP input, manpower, machinery and equipment, buildings and training necessary to develop oilseed production capability in Pakistan. The economics of oilseed production is one phase of four development projects on oilseed production. The overall project includes six separate and distinct research and development projects. Only three of these would initially have an economic analysis component. The five major oilseed development project proposals are: (1) dobari lands, (2) cotton-fallow lands, (3) legume inoculum research and development, (4) groundnut production and (5) seed production.

The Integrated Economic Research on Oilseeds Project

Oilseed production projects on various types of land and in different cropping systems should include personnel who can do an economic analysis on crop costs and returns. Farmers who raise oilseed crops on dobari, cotton-fallow or barani areas need to know what the comparative costs and returns of the various alternatives are. Farmers need to know the marginal yield increase per added unit of input as well as the marginal cost and returns for that input before an expanded program can be successfully promoted.

Millions of acres of land are lying fallow between crops and are inefficiently used, even when planted to oilseed crops. These areas have the potential of much higher yields with a commensurate economic return. That return would benefit the farmer, agribusiness and ultimately the nation by generating income, investments and jobs, and reducing the drain of foreign exchange outlays. The development of a profitable oilseed industry would generate a new income flow for many people.

1. Project Description

a. Objectives

- To identify the costs for producing different oilseed crops.

- To quantify the comparative returns for producing oilseeds and traditional food crops (wheat and rice) or forage.

- To evaluate the economic worth of varying inputs based on the yields of different crops and mangement systems.

- To evaluate the variation in income associated with different crop rotations when oilseeds are included.

- To evaluate changes in economic return when new equipment is introduced.

- To evaluate the effects of and returns to adaptive research.

b. Location and Institutions

Each of the crop research and development projects will have an economic analysis component integrated with the production units. The economic research unit will gather the data from farmers who are growing the oilseeds. They will also work closely with the production researchers on each project. The economists will be closely involved in research design so that economic data can be collected and analyzed from the outset. This procedure will be more difficult to accomplish in the farm machinery project until some prototypes are ready for field testing.

c. Personnel and Budget

Initially, three of the development projects will require an economic input to determine the cost-returns and profitability of the crop or crops concerned. These are the dobari, cotton-fallow and groundnut production projects. To accomplish this objective the following would be required:

Staff (Professional):

1. One expatriate advisor: preferably a Ph.D. in agricultural economics with a bias toward production economics. He should have considerable experience in developing countries and working with technical researchers. This person will be located in Islamabad and will travel frequently to all project sites to advise the Pakistani agricultural economists.

2. Six Pakistani agricultural economists with at least an M.S. degree in agricultural economics or economics and four years' working experience. These economists should be thoroughly familiar with production techniques. They will be located, two per project area, in the cotton-fallow, groundnut and dobari projects. One will work directly with the researchers in project design to obtain economic results and will monitor them; the other will collect and analyze farm input/output data.

3. Fifteen field assistants per project area who will collect on-farm information for use in calculating farm management cost/return data. They will live in villages in the project area and collect input/output data and will be supervised by the agricultural economists.

Vehicles: The project advisor and each agricultural economist should have a suitable vehicle for travel in the project areas. This would most likely require 4 x 4 vehicles; thus, 7 vehicles would be required, plus operating funds.

Training: All the agricultural economists would require some training in farm management and farming systems economics. Training would be overseas for a three to six month duration. At least one of the six will be trained to the Ph.D. level to eventually replace the expatriate advisor. Selection should be based on field performance and potential capabilities as a researcher and administrator.

Table 3

Budget for Integrated Economic Research Project
(Four Years)

		Rs.	U.S.$
1	Project Advisor, expatriate	1,440,000	600,000
6	Agricultural Economists, expatriate, short-term consultants	--	200,000
45	Field Assistants	700,000	--
	Clerical Staff, Drivers	400,000	--
	Training (short and long-term)	--	504,000
7	Four-wheel Drive Vehicles	--	160,000
	Office Equipment	400,000	--
	Computer	--	--
	Recurring Expenses (travel, supplies, materials)	1,046,000	--
	Contingencies (15%)	537,900	224,000
	TOTAL	3,523,900	1,718,100

2. Measurement of Progress and Monitoring Results

The agricultural economist who is leader of each economic analysis unit will prepare an annual plan of work with benchmarks for accomplishment within specified time frames. He will work closely with his staff in preparing the annual plan of work to include expected goals and the points in time when they expect to reach these goals. Semi-annual reports will be submitted to the project manager showing the percentage of completion of each goal, the expenditures and a statement explaining any lack of accomplishment and procedures for rectifying the problem.

The project manager submits his progress reports to the Oilseeds Production Steering Committee. A detailed report of accomplishments and expenditures shall be submitted by each agricultural economist to the project leader each year. They will discuss the report and the project leader will integrate it with the overall report for the research unit.

Short-term consultants are also expected to submit reports evaluating progress before departing from Pakistan.

3. Social/Economic Benefits and Constraints

Assuming the project increases farmers' incomes and spurs growth in agricultural businesses servicing farmers, there could be a marked effect on the citizens in the project area. Those whose livelihood depends on agriculture would be most affected. The more intensive use of dobari lands would increase both farm output and net farm income. This would have a profound effect on the economic health of the region.

Disposing of the residual oilcake and meal profitably is a possible constraint in this project.

4. Environmental Impact

The growth of an industry requires additional processing plants, transportation and other infrastructure to support the industry. If the oilseed project expands as expected, oil mills, seed plants, storage and cleaning of commercial seed and added transport for raw products, seed and processed products will all have an impact on the environment. This may result in more congestion in urban centers. There may also be more dust and other pollutants from plants that clean, mill, dry and store the oilseeds, and more hydrocarbons from the trucks transporting inputs and outputs.

5. Policy Commentary

Introduction of these additional oilseed crops should receive strong local support. Farmers and businessmen in

agricultural areas are likely to support a project that promises to improve the economic lot of farmers and expand local business activity.

GROUNDNUTS, SOYBEANS AND CROP PRODUCTION SYSTEMS

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Summary and Recommendations

Research programs to generate the necessary technology should cover crop improvement and crop production systems. The crop improvement research for oilseed crops in Pakistan should include: (i) genetic improvement; (ii) variety adaptation; (iii) insect problems--control; (iv) oil and protein quality; (v) disease problems--control; (vi) seed quality; (vii) fertility requirements; and (viii) harvestability.

The soybean and groundnuts crop improvement programs were evaluated using the eight components of this system. Improvement research programs for soybeans and groundnuts need to be linked with INTSOY and the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT). Crop improvement research is regarded as a charge of the National Agricultural Research Center (NARC).

Research on crop production systems to fit the best oilseed crop into the highest net return system for Pakistan must include the following components: (i) cropping system scheme; (ii) variety selection; (iii) soil preparation; (iv) plant populations; (v) inoculation and fertility; (vi) moisture management; (vii) weed control; (viii) insect control; (ix) disease control; (x) harvest and grain quality; (xi) marketing and profitability; and (xii) training.

This system was used to evaluate the constraints on oilseed production. Priorities for oilseed crop production systems research need to be identified. In Pakistan, crop production systems research as it relates to adaptive and development research is a charge of the provinces. There is a need for greater linkages, support and services to provincial research on crop production systems.

To increase the production of groundnuts, soybeans and other edible oilseed crops, the following six projects were proposed:

1. Cotton-Fallow Cropping System Project
2. Legume Inoculation Research-Development Project
3. Groundnut Research-Development Project
4. Machinery Improvement-Development Project
5. Research Augmentation Project
6. Training Coordination Project

How the Study was Conducted

A. Background

Information was collected by:

(1) review of production, statistical and research reports on edible oil crops in Pakistan;

(2) visits to national and provincial research centers engaged in edible oilseed crop research;

(3) visits with private and quasi-government industry involved or related to oilseed crops;

(4) on-farm visits to discuss oilseed production practices, problems and scope; and

(5) visits with institutions responsible for rural extension programs.

This afforded the opportunity to obtain a broad, but not necessarily comprehensive, view of the strengths, weaknesses and gaps in the edible oilseeds research and production programs.

This report will emphasize the research needs of the traditional crop--groundnuts, the nontraditional crop--soybeans, and a number of programs needed to improve production practices.

The national food and fiber production priorities will be considered in increasing production, i.e., that oilseed crops are not to displace the production of (i) the cereals: wheat, maize and rice; (ii) cotton as an export earning fiber crop; and (iii) the fodder crops used for high quality animal feeds. Therefore, it will be necessary to consider expanded production of the edible oilseed crops as (i) a second or third crop in a cropping system program; (ii) a potential opportunity crop to best utilize the natural water-soil resource; and (iii) a best potential income alternate crop in case of delayed or lost plantings of one of the national priority crops.

B. Major Findings

In general, the major strengths in the existing situation are:

1. the understanding of the national need to increase production of edible oilseeds;

2. the private sector progress in developing the technical infrastructure and technology to move foward;

3. a small nucleus of high-caliber people interested and knowledgeable in oilseeds and crop production;

4. the high level of the profitability concept for cropping systems by large and small farmers in Pakistan; and

5. a fairly good understanding of which locations and what cropping systems could best increase production of edible oilseed crops.

To evaluate specific strong and weak points of the existing situation, it is necessary to outline the components for a Pakistani oilseed crop improvement program and crop production system. In a traditional split of research responsibilities, NARC assumes the major role in crop improvement research (fundamental research) and the provincial institutions play the major role in crop production systems research (production technology research). If all components are included, this specialization should generate the technology for increasing edible oilseed production.

1. Crop Improvement Program Evaluation

Figure 1 shows the components of a successful integrated crop improvement program.

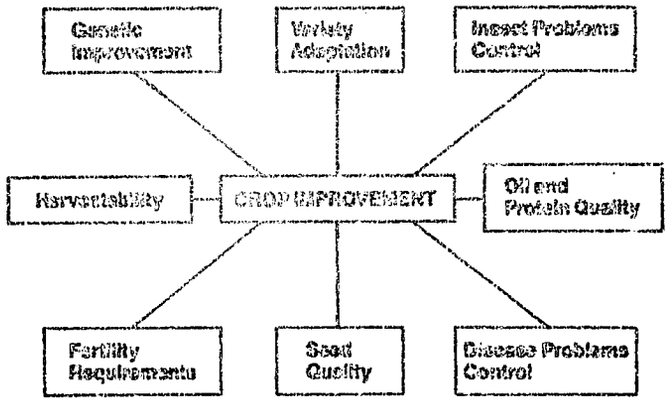
a. Soybeans

The major effort in soybean crop improvement has been the search for adaptive varieties suited to potential soybean growing areas. The goal is to fit a 90-day variety into a cropping system with a high priority crop. This program apparently has received outside assistance from INTSOY or other institutions. A breeding program in soybeans does not exist and probably should not be encouraged at this time.

Oil and protein analyses capabilities exist in a number of locations in support of oilseed crop research, but do not appear to be a part of the program. Insect and disease problems, while observed by some researchers, are not a direct part of the variety adaptation program. The adverse effects of high temperatures at the time of soybean maturity upon seed quality have been identified and must be considered in a seed multiplication program.

Figure 1

Necessary Components for a Crop Improvement Program



Fertility research has two thrusts: (1) comparison of Rhizobium japanium strains (both local selections and imported strains); and (2) yield and nodulation of soybean with inoculum only and inoculum plus fertilizer. Only the INSTOY variety adaptation trials had soil analysis data on the fertility level of the experimental site. There appeared to be little linkage between the soil science people and the soybean program.

There are three problems in harvesting soybeans in Pakistan: (1) shattering in some varieties; (2) plant height as a problem in mechanical harvesting but not in hand harvesting; and (3) conventional threshing and the use of threshers developed for wheat causing excessive seed damage.

b. Groundnuts

Little mention of a crop improvement and variety adaptation program was made at the experimental station visited. There was no evidence of links between the Pakistani groundnut improvement program and ICRISAT or any institution in a major groundnut-growing country. Some selection of bunch versus spreading types of groundnuts appears to have occurred in an effort to move to mechanical harvesting.

Efforts to design a mechanical groundnut harvester for manufacture in Pakistan have been unsuccessful. A suitable Rhizobium inoculum to fix atmospheric nitrogen and replace nitrogen fertilization does not appear to exist. A visit with the Canadian

International Development Agency (CIDA) program revealed they had not planned to include groundnut improvement and variety adaptation in their barani lands project. A groundnut improvement program would need to be coordinated with the CIDA barani lands research and development project.

2. Integrated Oilseeds Crop Production System

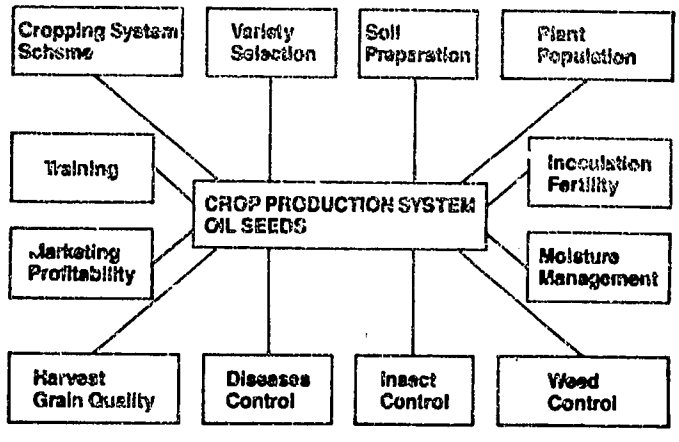
The twelve components needed for a successful research on oilseeds crop production systems in Pakistan are presented in Figure 2. The following will briefly summarize the present status of crop production systems research apparent state-of-the-art in production technology for soybeans and groundnuts.

a. Soybeans

There are only 3,237 hectares (1981-82) now under soybean production in Pakistan, primarily in the Northwest Frontier Province. There does not appear to be a unified research program on crop production systems outside the GCP that includes soybeans. Farmer acceptance of soybeans as a crop and yields of over 3,000 kg/ha were reported. Research yields from some stations of 2,000 to 2,700 kg/ha were reported. Therefore, adaptable varieties and some understanding of cultural practices exist, but this appears to be a result of technology transfer rather than a product of research.

Figure 2

Components of the Crop Production Systems Research



b. Groundnuts

A technology bulletin published by PARC contains the most recent information on groundnut production. The apparent bottleneck to groundnut production is the problem of digging, removing from the vine and shelling in a timely fashion to ensure freedom from aflatoxin. Labor requirements are high and labor is not always available. Often, the groundnuts remain in the soil, are subject to molding and become infested with aflatoxin. Attempts to develop a locally fabricated groundnut digger have been unsuccessful.

c. Priority Areas for Change

During the kharif growing season, only cotton and groundnuts are planted as major oilseed crops. During rabi, the major oilseed crops are mustard, rape and, to a lesser extent, sunflower and safflower. Sesamum, which is high in oil, is planted more as a decorative food than an oil crop.

The major potential areas for increased production of oilseed crops are:

1. Sunflower, safflower and mustard on the dobari lands, of which about .52 million hectares are not presently used.

2. Soybeans and/or sunflower as the second crop after cotton of which about .50 million hectares are now left fallow.

3. Safflower and mustard on about 1.6-2.0 million hectares of "kacha" (riverine) lands along riverbeds which could be planted during rabi season.

4. More extensive cultivation of barani lands which would increase crop production.

Crop production systems research programs for groundnuts and soybeans for kharif planting need to be studied and expanded. There is a good understanding of the best potential cropping systems by soil-climatic region, but more site-specific research on crop production is needed to develop technology to increase production.

Priority areas for research, development and crop improvement needs are as follows:

1. **Variety Adaptation.** A quality looked for in selective sunflower and soybean varieties/hybrids was the ability

to mature in 85-95 days. In soybeans, a variety should exhibit indeterminate flowering habit. A limited program has selected a hybrid sunflower and the soybean variety *Williams*, maturity group III, to have high potential yield. These programs will need intensification.

A continuous uniform program is needed in soybean variety selection for the adaptive soil-climatic regions to find the best varieties for cropping systems on the unused land. A very active program in evaluation and selection of adaptable bunch-type groundnuts is a high priorit to start the development of this crop. Another high priority is soybean and/or sunflower date-of-planting and economic comparison studies with maize, wheat and cotton to determine the "best cropping system alternatives" to maximize total income per acre.

2. Soil Preparation. Research and development on tillage should be a high priority since tillage affects timely planting and can achieve a maximum, uniform population. Broadcasting safflower, sunflower and soybean seeds on the soil surface and attempting to cover them with a desi plow or field cultivator on a tractor-powered plow results in uneven stands. This is particularly noticeable on the dobari lands where the seedbed for safflower and sunflower is very cloddy, rough and uneven.

The development of a rotary hoe with seed and fertilizer box, both tractor and bullock-drawn, holds great potential for improved seedbed preparation for sunflower and on dobari lands for winter planting of safflower. No-till planting research should also be undertaken on these lands. This will require some special planter development work but should be considered a priority item. Systems of land-forming as a cultural practice in groundnut production should be tested to determine yield, harvestability and quality effects.

3. Plant Population. The development of row planters, both tractor and bullock-drawn, for sunflowers is a necessity for more uniform plant height and population. Research needs to determine the maximum plant yield populations for a number of oilseed crops. With the short growing season of soybeans, adaptation of the present grain drills with press wheels will serve to obtain higher populations and maximum yield.

Increasing the plant population of safflower alone could in itself double yields, and coupled with fertilizer use, could triple yields on dobari lands. Well-

conducted research in farmers' fields is needed to confirm this potential. Because of the short growing season of soybeans, work is required to establish the best population and row spacing. Both research and field development efforts are required to mechanize planting to the best row spacing and populations for maximizing yields. Plant populations of new groundnut selections using a high level of management will need to be tested under farmers' field conditions to determine input requirements for specific soil types.

4. Fertilizer Requirements. Fertilizer requirements of oilseed crops in a cropping scheme by soil-climatic region does not appear to be well understood. Most research is based on bags of Urea (46% N), DAP (18% N and 46% P_2O_5) and nitrophos (23% N and 23% P_2O_5). Because of the high salt levels of Pakistani soils, MAP (11% N and 48% P_2O_5) would appear to be a better phosphorus material than DAP. More work is needed to relate soil chemical properties (O.M. and available P_2O_5) to nutrient response to better understand the fertilizer economics for oilseeds.

Published research reveals significant yield response when soybeans are inoculated with locally selected and imported strains of Rhizobium japanicum. However, numerous field reports indicate that locally produced inoculum was not effective in nodulating soybeans, while imported materials gave good nodulation. Rhizobium used must nodulate early and fix nitrogen at a high rate because of the short growing season. Assistance will be needed to develop the commercial production and distribution system necessary for quality inoculum.

Because of the high requirements for nitrogen in the fertilizer recommendations for groundnuts, it appears that this crop is also in need of a Rhizobium research and development program.

5. Moisture Management. The planting of safflower and sunflower on dobari lands after rice must be delayed until the soil dries sufficiently to enable the movement of tractor or bullock over the land. This problem could be solved by a complete irrigation and drainage system, allowing removal of excess surface water when rice is physiologically mature. This would shorten the time after rice harvest until the soil is dry enough to plant safflower and sunflower.

Because the cotton-fallow lands were not visited, little is known about water management programs for

sunflower or soybeans. The GCP reported that many growers use three to four irrigations for sunflower. Practical water management programs by crop-soil-climate would need to be developed. Soils with sufficient moisture/rainfall and texture suitable for groundnuts also need to be identified.

6. Pest Management. Outside of cotton, there appeared to be little knowledge about weed problems and chemical control measures for oilseed crops. Low yields apparently preempt any attempt to control weeds in mustard, rape and safflower, and the other nontraditional crops are too new or are weeded by hand. No weed control research as a function of plant population and soil preparation with oilseed crops was encountered. This discipline, under a pest management program, will be needed as more intensive, high-yielding crop production systems are developed.

   Insects and insect damage of oilseed crops have been observed in the field, but economics of control or plant tolerance are not included in the research program. Cotton is the exception, where an estimated 60 percent is protected with pest control chemicals. It is quite possible that because of poor stands and low yields, interest in insect control on the oilseed crops, other than cotton, does not exist. Therefore, yield maximization appears necessary to stimulate insect control programs. The major pest problems reported on oilseeds are parrots on sunflowers, aphids, white fly, mites and a root-borer on soybeans.

   Some constraints to pesticide use are (1) controlled, limited importation, (2) the high cost of imported products and (3) the lack of sprayers and knowledge of their use.

7. Harvest--Grain Quality. Harvesting to obtain a quality grain with the oilseed crops has not received much attention. There does not appear to be a standard of quality for the grain of oilseed crops. A few large farmers have machines suitable for oilseed harvesting, but a major share of the crop is threshed by bullock and other traditional methods, or with a stationary thresher designed for wheat or rice. Thresher modification would be necessary for a quality oilseed grain. A small, manpower-driven thresher would need to be developed for small farmers and sharecroppers. Digging and vine separation equipment is a high priority development need to stimulate groundnut production.

8. **Training.** According to Muhammed and Khan,[1] there are no plant physiologists or soil scientists presently working on oilseed crops. The only Ph.D.'s are in plant breeding (2), agronomy (2) and oil/food technology (1). There is a lack of sufficient numbers of educated and trained research-production personnel and both short-term and long-term (Ph.D.) training is a high priority.

d. Priority Projects

The following six projects were written based on the background information and the evaluation of the crop improvement research programs for groundnuts and soybeans, and the crop production systems research program:

1. Cotton-Fallow Cropping Systems Project
2. Legume Inoculum Research Development Project
3. Groundnut Research-Development Project
4. Machinery Improvement-Development Project
5. Research Augmentation Project
6. Training Coordination Project

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[1]Amir Muhammed and A. Rehman Khan, Perspectives of Edible Oils Research and Production in Pakistan, Pakistan Agricultural Research Council, Islamabad, 1981.

I. Cotton-Fallow Cropping System Project

A. Area and Present Use

There are 2.21 million hectares of cotton in Pakistan--about 1.57 million hectares in the Punjab and 0.64 million acres in Sind Province. There is very little cotton in NWFP and Baluchistan Provinces.

B. Estimated Potential: Area, Crops, Yields, Production

Of the 2.21 million hectares in cotton, about 70 percent is cropped to wheat and fodder (1.55 million hectares) and about 0.64 million hectares is left fallow. In winter, this is divided into about 0.44 million hectares in Punjab Province and 0.22 million hectares in Sind Province.

Two crops--sunflower and soybeans--can be grown as 90-100 day crops after cotton is harvested in November-December, and before it is planted again in May-June. The GCP is strongly pushing sunflowers and is seeking to reach 0.2 million hectares in Punjab Province alone. Sunflower yields of 2,717 kg/ha and 1,767 kg/ha have been reported by growers for GCP, with a yield of 3,620 kg/ha being the highest reported. The national average in Pakistan was reported at about 1,120 kg/ha. These higher reported yields were under three to four irrigations with fertilizer.

Very little data are available on soybean yields at the farm level. A yield of 3,100 kg/ha with February plantings was reported in the Multan area. On an oil-per-acre basis, sunflowers have the potential to outyield soybeans and thus will probably receive greater, immediate attention. Unless sunflowers are hulled before oil extraction, the meal will not have the resale value of soybean meal. Therefore, both crops will need attention according to the marketability of the oil and meal.

C. Project Description

1. Purpose

This project relates to introducing oilseed crops into the cotton lands that now remain fallow during the period from December to June. The crops of sunflower and soybean have high potential to maximize returns in a more intensive cropping system. The program of work undertaken will e adaptive research--development in nature with major emphasis the field. The major objectives are:

(1) Selection of the most adaptive variety/hybrid of oilseed crops to maximize yields of edible oil and returns to farmers in the cotton cropping system.

(2) Work with the machinery project to develop the best low-energy soil preparation, planting and harvest equipment for small and large farmers.

(3) Determine optimum populations for the individual oilseed crops and methods to obtain stand establishments.

(4) Work with the inoculum project for field testing soybean inoculum in various soil-climatic environments.

(5) Determine the optimum fertilizer nutrient requirements for maximum economic yield.

(6) Determine the optimum use of irrigation for maximum yield.

(7) Identify major pests, insects, diseases and weeds and their respective control systems.

(8) Provide long-term (degree) and short-term training to develop an effective oilseed research team.

(9) Work closely with appropriate provincial institutions and private and public industries to maximize production from cotton-fallow lands.

A major end product will be an effective and functioning cropping systems research-development program. The program will maximize total production on a cotton-oilseed sequence in much of the area now fallow after cotton.

2. Location

With the major portion of the cotton-fallow in lower Punjab Province, a likely location for this program would be in Multan. There is a Central Cotton Research Institute located in Multan that has received technical assistance through the Food and Agriculture Organization (FAO). This is a possible location for a donor/Pakistan research and development team on cotton-fallow crop production systems. A satellite location could be Kot Diji to serve the need in Sind Province.

3. Organization, Personnel and Responsibilities

The expatriate advisor should be a production agronomist with experience in oilseed crops and/or cropping systems. The role of project director would best be served by an oilseed botanist. A list of staff and desired grades follows. The basis for staff selection should include experience with oilseed crops, particularly sunflower and soybean, and knowledge of cotton-fallow systems.

ADMINISTRATION, TECHNICAL AND SUPPORT STAFF

Administration

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Project Director	G-20	200,000	-
1	Deputy Director-- Expatriate Advisor (5 years)		-	750,000
			200,000	750,000

Technical

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Oilseed Botanist	G-19	160,000	-
1	Soil Chemist	G-18	130,000	-
1	Entomologist	G-18	130,000	-
2	Agronomists	G-18	260,000	-
1	Plant Pathologist	G-18	130,000	-
2	Agricultural Engineers	G-18	260,000	-
1	Agricultural Economist (Production)	G-18	130,000	-
0.25/Yr	Short-term Advisors (Expatriate)		-	125,000
			1,200,000	125,000

Support Staff

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Adm. Assistant	G-11	45,000	-
3	Stenographers	G-8	42,000	-
1	Senior Clerk	G-4	35,000	-
1	Junior Clerk	G-5	30,000	-
3	Tractor Drivers	G-5	75,000	-
2	Laboratory Assistants	G-11	80,000	-
15	Peldars	G-1	225,000	-
6	Drivers	G-5	150,000	-
			682,000	-

*G.O.P. Grade.

Total

Description	Cost Rs.	Cost U.S. $
Administration	200,000	750,000
Technical	1,200,000	125,000
Support Staff	682,000	-
TOTAL	2,082,000	875,000

4. Building

The project should be housed in a research institute or institutes located in the provinces. The provinces are expected to participate in the program by providing suitable office space, laboratory space, equipment storage and repair space, and other work space necessary to ensure success of the project.

5. Equipment Costs

Nonrecurring Expenses

Item	Cost Rs.	Cost U.S. $
3 Wagons or Broncos, right-hand drive for director, advisor, short-term advisor	900,000	-
3 Jeeps or pickups for technical staff	600,000	-
8 Motorcycles	80,000	-
3 Tractors with accessories	450,000	-
3 Power Sprayers	25,000	-
1 Backpack sprayer (pesticides research)		1,500
3 Threshers (research plots)		12,000
2 Seed blower-cleaners		1,000
2 Trailers	30,000	-
3 Hand-push cone planters		7,500
3 Moisture meters		2,000
Laboratory Equipment: balances, incubators, ph meter, calorimeter, tapes, etc.	300,000	50,000
Office Equipment: furniture, typewriters, photostat, audiovisual, calculators, etc.	240,000	10,000
Contingency Equipment (15%)	395,000	13,000
	3,020,000	97,000

6. Allowances*

No.	Items	Cost in Rupees Annual	5-Year
1	Housing Allowance	132,000	660,000
1	Furniture (once)	-	310,000
1	Family Transfer	-	266,000
1	Furniture Storage	-	-
1	Education	-	-
1	R&R (2 times)	-	-
1	Home Leave (2 times)	-	180,000
1	Dependent Visits	-	-
1	Contingency	-	25,000
		132,000	1,441,000

*Allowances for technicians.

7. Training (Five-Year Estimates)

No.	Program	Cost Rs.	U.S. $
10	Short-term	500,000	25,000
5	Degree Programs	1,000,000	350,000
		1,500,000	375,000

8. Measuring Progress and Results of the Project

The following criteria should be used to monitor and measure results of the cotton-fallow project.

(1) Effectiveness of staff assignment and their functions in the program.

(2) Development of functioning laboratories, offices, equipment purchases and delivery.

(3) Initiation and accomplishments in developmental research.

(4) Completion of training programs.

(5) Achievement of a funtioning program to improve oilseed production and net income on cotton-fallow lands.

(6) Degree to which program integrates with province programs.

(7) Decrease in dependence upon imported oilseeds.

9. Budget Estimates--Donor and GOP

The system to estimate costs and budget development are presented in Sections "3. Organization," "5. Equipment," "6. Allowances" and "7. Training."

Summary Budget
(Five-Year)

Item	Cost Rs.	Cost U.S. $
Expatriate Long and Short-term Advisors		875,000
Pakistani Staff and Technicians	2,082,000	-
Equipment	3,020,000	97,000
Allowances	1,441,000	-
Training	1,500,000	375,000
TOTAL	8,043,000	1,347,000

The benefits package for the Pakistani staff is not known at the time of this budget presentation.

D. Environmental Impact

This project has high potential to make better and more complete use of land suited for agricultural production. Better management practices, soil stewardship and environmentally sound use of agricultural inputs should lead to favorable ecological changes. Expanded plantings on these lands during winter should remove surface water from the soil and reduce salt accumulation on the surface through high, upward percolation and evaporation of water from the soil surface.

E. Policy Commentary

This project has been discussed as a high priority project with excellent potential to succeed and increase oilseed production.

F. Social and Economic Benefits and Constraints

The social and economical benefits are manyfold and include (i) reduced imports of edible oil; (ii) increased income in rural areas; (iii) benefits to small farmers; (iv) greater use of natural resources; (v) better quality food products; and (vi) potential material for animal industry development.

The social and economic constraints are primarily (i) the lower level of literacy in the rural areas and (ii) the lack of investment capital among small farmers.

II. Groundnut Research-Development Project

A. Area and Present Use

There are 59,700 hectares of groundnuts production in Pakistan, with a mean yield of 1,209 kg/ha. Over 90 percent of the plantings are concentrated in Punjab Province, primarily in Attock, Jhelum and Rawalpindi Districts.

B. Estimated Potential: Area, Yields, Production

There are 6.0 million hectares of cultivated land in Pakistan which are rainfed. Much of this is referred to as barani lands. The total area best suited for groundnuts has not been assessed, but reports suggest much of the barani area as well as other lands are suitable for groundnut production. The lack of a selection program, the necessary package of technology and suitable harvesting equipment have resulted in low yields of poor quality groundnuts. A research-development project to overcome these constraints could easily triple production.

C. Project Description

1. Purpose

The project will undertake the following research-development activities:

(1) Select and introduce the most adaptable bunch-type groundnuts for barani lands. These would also be adaptable on a national scale.

(2) Evaluate and select *Rhizobium* strains that will fix nitrogen to minimize nitrogen fertilizer requirements for groundnuts.

(3) Develop suitable planting and harvesting equipment to facilitate a groundnut expansion program.

(4) Work with the seed industry and the inoculum project to commercialize the production, certification and marketing of high quality groundnut seed and inoculum.

(5) Develop the necessary technology (seed rate, fertility, row spacing, pest management, etc.) to bring the production of bunch-type groundnuts to a commercial state.

2. Location

The program could be located in NARC because 90 percent of the plantings are nearby and the most likely area for

acreage expansion in the three districts is in north Punjab Province. Land with soil more representative of groundnut soil will need to be purchased or rented under a long-term arrangement and used for groundnut research only. Satellite programs linked to the central groundnut research-development project should be established in the provinces.

3. Organization: Personnel and Responsibilities

An expatriate advisor with background in groundnut breeding and variety selections will be needed to organize and initiate a groundnut variety adaptation selection program. He will travel and obtain collections from ICRISAT and work with their outreach program. A Pakistani counterpart in the genetics and breeding area will work with the advisor to eventually take over the programs.

Other professional personnel necessary to generate the production technology are expected to be Pakistani and are listed below. Short-term expatriate advisors will be required for the five-year period to support the program.

ADMINISTRATION, TECHNICAL AND SUPPORT STAFF

Administration

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Project Director--Oilseed Botanist	G-19	160,000	-
1	Deputy Director--Expatriate Advisor (5 years)		-	750,000
			160,000	750,000

*G.O.P. Grade.

Technical

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Soil Microbiologist/ Chemist	G-18	130,000	-
1	Agronomist	G-18	130,000	-
1	Plant Pathologist	G-18	130,000	
1	Entomologist	G-18	130,000	-
0.25/Yr	Short-term Advisors (Expatriate)		-	125,000
			520,000	125,000

*G.O.P. Grade.

Support Staff

No.	Description	Grade*	Cost Rs.	Cost U.S. $
2	Stenographers	G-11	70,000	-
2	Senior Clerks	G-6	35,000	-
2	Laboratory Assistants	G-11	80,000	-
2	Drivers	G-5	50,000	-
2	Tractor Drivers	G-5	50,000	-
2	Baldars	G-1	45,000	-
			330,000	-

*G.O.P. Grade.

Total

Description	Cost Rs.	Cost U.S. $
Administration	160,000	750,000
Technical	520,000	125,000
Support Staff	330,000	-
TOTAL	1,010,000	875,000

4. Building

The project will be in NARC, with suitable offices and laboratories provided. The project must purchase or lease six to ten hectares of land with soil representative of the most productive groundnut lands. This soil does not exist in the NARC research area. Suitable buildings to store field equipment and supplies, and to handle some soil and plant materials will also be needed. Certainly not more than Rs 350,000 would be required for land purchase.

5. Equipment Costs

Nonrecurring Expenses

Item	Cost Rs.	Cost U.S. $
2 Wagons or Broncos, right-hand drive	600,000	-
1 Pckups	150,000	-
2 Motorcycles	20,000	-
2 Tractors with accessories	300,000	-
2 Power Sprayers	16,000	-
1 Backpack sprayer		1,500
3 Hand-push cone planters		7,500
1 Moisture meter		1,000
1 Trailer	15,000	-
Digging, picking and shelling equipment	-	50,000
Laboratory Equipment: balances, etc.	100,000	30,000
Office Equipment: visual aids, calculators, etc	75,000	10,000
Contingency Equipment (15%)	184,000	-
	1,460,000	100,000

6. Training (Five-Year Estimates)

No.	Program	Cost Rs.	Cost U.S. $
5	Degree Programs	1,000,000	350,000
3	Short-term	150,000	7,500
		1,150,000	357,500

7. Measuring Progress and Results of the Project

The following criteria should be used to monitor and measure results of the groundnut research-development project:

(1) Effectiveness of staff assignments and their output in the program.

(2) Opening of offices, acquisition of land with a soil representative for groundnut production and purchase of equipment and supplies.

(3) Acquisition and plantings of genetic materials to select high yielding adaptive varieties.

(4) Initiation of groundnut *Rhizobium* strain selection program.

(5) Initiation of programs to develop crop production technology.

(6) Completion of degree and short-term training programs.

(7) Release of a high yield groundnut variety, *Rhizobium* strain, and the technology to increase groundnut production.

(8) Mechanization of groundnut digging, picking and shelling.

(9) More edible oil is derived from groundnuts in Pakistan.

8. Budget Estimates, Donor and GOP

The systems used to estimate costs and budget formation are presented in Sections "3. Organization," "5. Equipment Costs" and "6. Training."

Summary Budget
(Five-Year)

Item	Cost Rs.	Cost U.S. $
Expatriate Long and Short-term Advisors		875,000
Pakistani Technical and Support Staff	1,010,000	-
Equipment	1,460,000	100,000
Training	1,150,000	357,500
TOTAL	3,620,000	1,332,500

D. Environmental Impact

The groundnut plant is a legume capable of fixing its total nitrogen supply. This will leave residual nitrogen i the soil for the following crop, generally wheat. This improves soil quality. Increase in cropping of barani lands during the summer season will protect the soil and reduce losses in land quality through soil erosion.

E. Policy Commentary

The project should lead to an increase in the high quality goundnut crop. Oil should be excellent for cooking and meal suitable as a protein supplement if high level extraction is employed. Successful completion should reduce aflatoxin problems as well.

F. Social and Economic Benefits and Constraints

The social and economic benefits are manyfold and include (i) increase in the profitability of groundnut production; (ii) potential for increased income for small farmers; (iii) less dependence upon nitrogen fertilizer for edible oil production; and (iv) potential high quality oil and protein meal for the livestock industry.

Social and economic constraints are primarily (i) the lack of adequate genetic material for a variety adaptation program; (ii) many failures in developing a successful groundnut digger; (iii) the low level of literary in the rural areas; and (iv) the lack of capital to purchase new technical inputs.

III. Legume Inoculum Research-Development Project

A. Present Situation

Two types of Rhizobium need research-development in Pakistan. They are Rhizobium for soybean and groundnuts. Research has revealed a significant response in soybeans inoculated with strain in Pakistan. Little appears available as an inoculum for groundnuts because this practice is not part of a production technology in Pakistan. PARC presently has a cooperative program with Nitrogen Fixation by Tropical Agricultural Legumes (NIFTAL) to evaluate Rhizobium strains for many legume crops. Reports from the field report lack of nodulation of soybeans when inoculum produced in Pakistan is used, but excellent nodulation with imported inoculum occurs. At present, inoculum is produced by research institutes with no attempt at commercial production.

B. Project Description

1. Purpose

This project will undertake three major activities:

(1) Initiate commercial production of Rhizobium for groundnut and soybean inoculation.

(2) Work with the groundnut project and the cotton-fallow project on variety-strain selection to obtain the most efficient nitrogen-fixing strains under Pakistani conditions.

(3) Work with the seeds marketing project to develop a system that would include inoculum with seed. This would ensure that farmers receive inoculum in a viable state.

2. Location and Institutions

The selection of efficient strains of Rhizobium for soybeans and groundnuts should be completed by NARC. Multiplication, production and marketing of viable inoculum should be a private undertaking. Pharmaceutical companies in Pakistan should be approached to undertake this production. A quality control program needs to be set up to ensure the sale of viable inoculum.

3. Buildings and Offices

No building program is needed for this project. Some special equipment and building materials may be necessary to assist the private undertaking of commercial inoculum production.

4. Organization: Personnel and Responsibilities

The initial responsibilities for technology transfer of research to commercial production of inoculum can be handled by a commercial *Rhizobium* productions specialist. The logical sequence of development would be as follows:

(a) Identify a company in Pakistan with microbiological programs that would commercially produce peanut and soybean *Rhizobium*.

(b) Work with the groundnut project to identify efficient *Rhizobium* strains for this crop and bring them into production.

(c) Work with seed marketers on effective packaging and distribution to ensure effective joint marketing of seed and inoculum.

(d) Work with the research program on adaptation to ensure continuous input of the most efficient *Rhizobium* strains into the commercial production and marketing system.

TECHNICAL AND SUPPORT STAFF

Technical

No.	Description	Grade*	Cost Rs.	Cost U.S. $
0.25/Yr	Short-term Rhizobium Commercial Specialist		-	125,000
1	Soil Microbiologist	G-19	200,000	-
			200,000	125,000

*G.O.P. Grade.

Support Staff

No.	Description	Grade*	Cost Rs.	Cost U.S. $
0.25/Yr	Laboratory Assistant	G-11	10,000	-
0.25/Yr	Stenographer	G-8	8,000	-
			18,000	-

*G.O.P. Grade.

Total

Description	Cost Rs.	Cost U.S. $
Technical	200,000	125,000
Support Staff	18,000	-
TOTAL	218,000	125,000

5. Equipment

Capital Materials

Item	Cost Rs.	Cost U.S. $
Growth Cabinet	-	25,000
Glassware, tubes, etc.	50,000	10,000
Environmental Control Switches	-	15,000
Packaging Machine	-	50,000
Micro-base Mixer	-	25,000
Miscellaneous Equipment and Fixtures	25,000	10,000
	75,000	135,000

Supplies, Miscellaneous Expenditures

Item	Total 5-Year Cost Rs.	Total 5-Year Cost U.S. $
Glassware and Supplies	25,000	5,000
Growth Media Materials, etc.	15,000	2,000
Travel (in Pakistan), Expatriate Advisor	50,000	-
Travel, Pakistani Staff	15,000	-
Contingency	15,000	1,000
	120,000	8,000

6. Allowances

Item	Total 5-Year Cost Rs.	Total 5-Year Cost U.S. $
Per Diem	491,400	2,000

7. Training (Five-Year Estimates)

No.	Program	Cost Rs.	Cost U.S. $
1	Short-term	25,000	5,000

A Rhizobium production specialist would receive short-term commercial training in an appropriate institution.

8. Measuring Progress and Results of the Project

The project should result in a functioning industry for producing and delivering the most efficient Rhizobium to the farmer for both groundnuts and soybeans. Progress can be measured by (1) equipment acquisitions, delivery and installation; (2) training completion; (3) start of commercial production of groundnuts; (4) start of groundnut and soybean inoculum production; and (5) favorable quality control reports and field results.

9. Estimated Budget

The estimated budget for the development phase is presented here. Research efforts would come under the groundnut and cotton-fallow projects.

Summary Budget
(Five-Year)

Item	Cost Rs.	Cost U.S. $
Expatriate Technical Staff	-	125,000
Pakistani Technical and Support Staff	218,000	-
Equipment	75,000	135,000
Supplies	120,000	8,000
Allowances	491,400	2,000
Training	25,000	5,000
TOTAL	929,400	275,000

C. Environmental Impact

Oilseed crops will fix and leave high nitrogen residues in the soil after the crop is harvested. Producing more oilseeds should enhance soil fertility. These crops should increase land utilization in a sound environmental crop production system.

D. Policy Commentary

This project conforms to Pakistan's policy of stimulating private industry to produce inputs to increase production of two of the edible oilseed crops.

E. Social and Economic Benefits and Constraints

1. Benefits

   a. Increased production of high yield oilseed crops.

   b. Improved income in rural areas.

   c. Less dependence on nitrogen fertilizer for edible oil production.

   d. Less dependence on foreign imports.

2. <u>Constraints</u>

a. High initial production costs.

b. Potentially higher price for packaging to maintain inoculum quality in Pakistan's marketing system.

c. Farmer's insufficient understanding of the importance of proper inoculum handling and use.

IV. Machinery Improvement-Development Project

A. Defined Need

The increase in edible oil production will require more intensive cropping systems on lands where wheat, rice, cotton and maize are now the primary cash crops. This will require planting of two crops annually where one is now generally grown. Some constraints to expansion in a two-crops-per-year system are:

(i) the long time required to harvest the major crop when a fast turnaround on land use is needed;

(ii) difficulties in proper seedbed preparation in a shorter time period;

(iii) poorer stands because of improper seedbed preparation; and

(iv) poor planting equipment to ensure high oilseed plant populations and maximum yields.

When these constraints are overcome, risks presently inherent in oilseed planting will be reduced. At that point, more fertilizer, pesticide and high-yielding genetic material can be easily and economically used.

Mechanization has increased rapidly in Pakistan with numerous machinery companies building equipment for Pakistani agriculture. A major development has been to mechanize wheat, rice, maize and cotton production. But there has been little development to meet specialized needs for oilseed crops. This is particularly noticeable in land preparation, planting and threshing equipment. This project will develop and adapt equipment to meet these needs and overcome this constraint in an intensive crop production system, thereby facilitating expansion in oilseed crop production.

B. Project Description

1. Purpose

This project will undertake the following machinery improvement-development activities:

(1) Determine equipment needs for seedbed preparation on dobari lands; determine if a suitable prototype is available and develop models for commercial production suitable for tractor and bullock power.

(2) Develop and produce modifications in the present cereal planters so they can also be used to plant the traditional and nontraditional oilseed crops.

(3) Develop modifications in the present cereal threshers so they can be used to thresh oilseed crops to give a chaff-free, high-quality oilseed grain.

(4) Modify and develop machines that will serve to dig and pick groundnuts.

(5) Work with the National Agricultural Research Center, Agricultural Machine Development (NARC-AMD) in the research phase of the program and require the production of a prototype model.

(6) Determine if machines need to be imported to serve as prototype models.

(7) Tie the development and field testing of equipment with the dobari, cotton-fallow and groundnut projects to assess the specifics of adaptability.

(8) Work with the commercial machinery sector on production of these improved soil preparation, planting and harvesting implements.

2. Location

The Pakistani Government has charged NARC-AMD with research and development of prototype implements for Pakistani agriculture. Perhaps the project should be located at NARC where any prototype work could be completed. Developmental work will need to be linked to the dobari, cotton-fallow and peanut projects and commercialization efforts linked with the machinery industry.

3. Organization: Personnel and Responsibilities

An expatrite advisor experienced in modifying, testing and developing for the implements will be needed to advise and direct the program. He will travel to obtain developmental designs from ICRISAT and IRRI since this may fit the needs for the dobari and groundnut projects. A Pakistani counterpart in agricultural engineering will be needed to work with the program and take over the leadership role. The expatriate advisor would be expected to serve a minimum of three years, and possibly five years, in the program. Other professional personnel have been identified in specific projects or will be deputized by NARC to serve the project. Short-term consultants will be included and would ennance commercialization.

ADMINISTRATION, TECHNICAL AND SUPPORT STAFF

Administration

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Project Director-- Ag. Engineer	G-19	200,000	-
1	Deputy Director -- Expatriate Advisor (4 years)		-	450,000
			200,000	450,000

Technical

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Assistant Engineer	G-17	110,000	-
1	Mechanic (Senior)	G-11	35,000	-
0.1/Yr	Short-term Consultant (Expatriate)		-	40,000
			145,000	40,000

Support Staff

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Stenographer	G-11	35,000	-
1	Clerk	G-6	16,000	-
1	Driver	G-5	25,000	-
1	Tractor Driver	G-5	25,000	-
			101,000	-

*G.O.P. Grade.

Total

Description	Cost Rs.	Cost U.S. $
Administration	200,000	450,000
Technical	145,000	40,000
Support Staff	101,000	-
TOTAL	446,000	490,000

4. Building

The project should be in NARC-RMD where suitable office, laboratory and equipment storage can be provided. This is where prototype development and equipment modification work would be completed. Field testing will need to be coordinated with other projects. Commercial scale production assistance will be given to the interested segment of the farm implement industry.

5. Equipment

Nonrecurring Expenses

Item	Cost Rs.	Cost U.S. $
1 Wagons or Broncos, right-hand drive	300,000	-
1 Pickup	150,000	-
1 Model and Component Imports	-	25,000
Shop Equipment	200,000	75,000
Office Equipment: typewriters, calculators, etc.	50,000	
Contingency Equipment (15%)	130,000	10,000
	845,000	110,000

6. Training (Five-Year Estimates)

Both short-term and degree training is anticipated in this program. Linkages to the international institutions, ICRISAT and IRRI will need to be investigated to determine if

training objectives and their programs are compatible. The training budget is as follows:

No.	Program	Cost Rs.	Cost U.S. $
2	Degree Programs	300,000	140,000
	Short-Term Training	50,000	5,000
		350,000	145,000

7. Measuring Progress and Results of the Project

The following criteria should be used to monitor and measure progress and results of the machinery improvement-development project:

(1) Staff is assigned and functioning.

(2) Acquisition of necessary project equipment, supplies and import materials.

(3) Prototype models purchased, built and field tested.

(4) Experimental machines tested under field conditions.

(5) Modified equipment tested under field conditions.

(6) Part casting necessities determined and initial contacts with metal industry completed.

(7) Commercial fabricators of farm implements contracted and agreements for production reached.

(8) First models roll off the production line.

C. Environmental Impact

The project will have no direct impact upon the environment. Because it will support other projects, there will be a favorable environmental impact in the form of better cropping systems management and improved rural life.

D. Policy Commentary

NARC-AMD will fulfill its charge to conduct mechanization research and building of prototype equipment; the provinces will conduct adaptive research; and the private sector will take up mass production.

E. Social and Economic Benefits and Constraints

Social and economic benefits include (i) increased mechanization in the agricultural sector and reduced drudgery in crop production; (ii) higher income per hectare and more income in rural areas; (iii) more jobs in the commercial area in implement fabrication; (iv) increased oilseed production and less dependence upon imports; and (v) more trained staff in the farm machinery research and development program.

Social and economic constraints are (i) preference by most technical assistants to invest rather than modify and adapt equipment to perform a specific function; (ii) lack of agricultural engineers in Pakistan with training to undertake this task; (iii) lack of capital in the private sector for manufacturing; and (iv) lack of capital in rural areas to purchase the equipment.

V. Research Augmentation Project

A. Defined Need

The oilseed research program in Pakistan includes 11 to 12 different crops which are planted and harvested at various times throughout the year. Expansion in edible oilseed crop production will require more intensive and extensive programs in crop improvement (Figure 1) and crop production systems (Figure 2) research. The need to strengthen the leadership in oilseed research at NARC has been identified. Planning and program assistance also needs to be strengthened in support of crop production systems research to be conducted in the provinces. To get the best return for research expenditures, there must be planning to identify the priority programs of crop improvement in oilseeds that would be NARC's responsibility, and the priority programs of the crop production systems research that would be the provinces' responsibility.

B. Project Description

1. Purpose

This project will do the following to augment oilseed crop research:

(1) Support the research management of the oilseed coordinator at NARC.

(2) Define the priority areas for research, the state-of-the-art and the need for research emphasis in crop improvement for the edible oilseeds.

(3) Define the priority areas for research, the state-of-the-art and the need for research emphasis in crop production systems research in oilseeds at the provincial level. Particular attention will be given to the dobari lands project, the cotton-fallow lands, kacha lands and groundnuts projects.

(4) Develop a strong national program of support for the crop production systems research of the provinces. This would include: (i) library and scientific information services; (ii) experimentation planning; (iii) analytical services; (iv) biometric and computer services and economic data evaluation; (v) special equipment acquisition and/or fabrication; (vi) laboratory instrument maintenance; and (vii) craftsmanship.

(5) Identify site-specific and subject-specific research and set priorities. Establish a specific research fund and grant-in-aid system (subproject system) to support the best research institutions.

(6) Help the oilseed coordinator develop a system of visitation, monitoring and support for the provincial crop production systems research. This would help insure that no bottlenecks occur which would impede progress.

(7) Work supportively with provincial research programs, crop production systems and the extension division to transfer new oilseed production technology to the rural areas.

(8) Work with the training, dobari, cotton-fallow, machinery, kacha, groundnut and inoculum projects, and provincial programs to identify training requirements. The most productive programs would include (i) joint Pakistan-donor institutional training; (ii) Pakistan-donor institute-international center training; (iii) other developing country institutions; and (iv) internships with donor industries. This would include identifying research projects, scientists and institutions.

(9) Organization of seminars, short courses and use of consultants to enhance crop improvement and crop productions systems research.

2. Location

The director of this project would be located at NARC because he will need to work directly with the oilseed coordinator. NARC would likely furnish adequate office space to house the director and his support staff.

3. Organization: Personnel and Responsibilities

An expatriate advisor experienced in oilseed crop research and research planning, coordination and administration will be needed to direct the program. He will probably travel extensively with the coordinator of oilseeds crops within Pakistan and to international centers as the need arises to all segments of the oilseed production program. A system of research planning, prioritizing and funding will be developed. Systems of support and coordination will also be needed.

ADMINISTRATION, TECHNICAL AND SUPPORT STAFF

Administration

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Project Director-- Expatriate Advisor (5 years)		-	750,000
			-	750,000

Technical

No.	Description	Grade*	Cost Rs.	Cost U.S. $
0.5/Yr	Short-term Consultants and Trainers		-	200,000
			-	200,000

Support Staff

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Adm. Assistant	G-12	60,000	-
1	Stenographer	G-11	45,000	-
1	Clerk (V.D.C.)	G-7	35,000	-
2	Drivers	G-5	50,000	-
2	Naib Qasid	G-1	28,000	-
			218,000	-

Total

Description	Cost Rs.	Cost U.S. $
Administration	-	750,000
Technical	-	200,000
Support Staff	218,000	-
TOTAL	218,000	950,000

*G.O.P. Grade.

4. Building

The project would be housed in NARC where sufficient office and other working space should be provided. Any modifications or improvements to streamline the operations would likely have to be paid from project funds. Therefore, Rs 250,000 is being budgeted to underwrite facility modifications.

5. Equipment Costs

Nonrecurring Expenses

Item	Cost Rs.	Cost U.S. $
2 Wagons or Broncos, right-hand drive and replacement	450,000	-
Office Equipment: furniture, typewriters, computer, visual aids, copiers, etc.	150,000	25,000
Research Support Equipment	100,000	25,000
Contingency Equipment (15%)	80,000	7,500
	780,000	57,500

6. Training (Five-Year Estimates)

Both short-term and degree training will be needed to augment the oilseeds research program. Short-term training will be in (i) specific scientific subject matter; (ii) research planning; (iii) project planning; (iv) research coordination; and (v) research budgeting and administration. Degree training in this project will address the needs of the crop improvement component, and the crop productions systems oil crops will be included in the development projects. The estimated training budget is as follows:

No.	Program	Cost Rs.	Cost U.S. $
5	Degree Programs	750,000	350,000
10	Short-term Training	250,000	50,000
		1,000,000	400,000

7. Measuring Progress and Results of the Project

The following criteria should be used to assess the progress and results of the research augmentation project:

(1) The establishment of an office; acquisition of office equipment, vehicles and supplies; and training of the support staff.

(2) The research priorities are identified for the components of the crop improvement program.

(3) The research priorities are set for the components of the crop production systems--oilseeds at the provincial level.

(4) Initiation of a contract, grants or subproject program with a priority formula system to utilize expertise of all institutions.

(5) Initiation of the system of NARC-to-provinces research support programs.

(6) Progress of the degree and short-term training programs.

(7) Establishment of functioning oilseeds crop improvement and crop production systems in Pakistan.

(8) Increased leadership by NARC in edible oilseed research.

8. Budget Estimates, Donor and GOP

The system used in budget formation and to estimate costs is presented in Sections "3. Organization," "4. Building," "5. Equipment" and "6. Training."

Summary Budget
(Five-Year)

Item	Cost Rs.	Cost U.S. $
Expatriate Long and Short-term Advisors		950,000
Pakistani Support Staff	218,000	-
Equipment	780,000	57,500
Building Modification	250,000	-
Training	1,000,000	400,000
TOTAL	2,248,000	1,407,500

C. Environmental Impact

This project is not likely to have an immediate impact upon the environment. Like other educational and research programs in the agricultural sciences, it will probably have positive long-term effects on rural economic and social life.

D. Policy Commentary

The success of this project would greatly assist NARC in focusing on crop improvement research and give leadership and support to the crop production systems research of the provinces.

E. Social and Economic Benefits and Constraints

The social and economic benefits would be (i) a more efficient crop improvement and crop production systems program for oilseeds; (ii) the production technology to greatly increase land use for and production of edible oil; (iii) the technology to increase income and the quality of life in rural areas; (iv) utilization of expertise in Pakistan and international institutions in training programs to facilitate more relevant subject matter coverage; and (v) closer links between NARC researchers and the research needs of the provinces.

Social and economic constraints include (i) shortage of qualified people to send for training; (ii) delays in obtaining GOP clearance to allow people to go for training; (iii) a large amount of leakage in the system whereby Pakistanis do not return to the job for which they were trained.

VI. Training Coordination Project

A. Defined Need

If research on oilseed crops is to be accelerated in Pakistan, several more persons must be trained at both the M.S. and Ph.D. levels. Training is needed in several disciplines, but the need is greatest in production technology followed by cultivation improvement. Such training can be obtained in large measure at the M.S. level. There is a need, however, to have some training at the Ph.D. level. Individuals trained at that level could then return to Pakistan and lead in developing in-country training programs. The development projects have a component of training built into them which will be summarized in this project.

B. Project Description

1. Purpose

It has been suggested that training/educational programs be participatory in nature, with donor-country universities cooperating with universities and NARC scientists in Pakistan to focus on pertinent problems. The student could complete the necessary course for the degree at a university abroad, and possibly begin research for a higher degree. The major portion of research, however would be completed in Pakistan and supervised on a continuing basis by a Pakistani scientist and on an intermittent basis by a major professor at the degree-granting university. The donor would pay expenses to enable the major professor or some other member of the student's research committee to visit Pakistan.

A second alternative training/education program would be to get ICRISAT and the International Rice Research Institute (IRRI) to cooperate with a donor-country university and then work on an approved project at the international center under the guidance of a scientist with supervision on an intermittent basis from the expatriate and Pakistani scientists. The research program would need to be a high priority at the international institute and meet the needs of Pakistan. The donor would need to pay all expenses to enable the major professors to visit the program in progress.

These programs must be carefully structured and supported by qualified scientists in both countries. Students in such a program must always have ready access to an advisor--whether he be an expatriate or Pakistani.

2. Location

The director of the training coordination project would be located at NARC because he would need to coordinate the

training with the scientists of NARC, the Director of the Research Augmentation Project and donor institutions. It is expected that NARC would furnish adequate office space to house the director and his support staff.

3. Organization: Personnel and Responsibilities

An expatriate advisor experienced in oilseed crop research, research planning and administration will be needed to organize and direct the program. He will need to work out priorities, training schedules and identify research needs and programs. He will locate participating scientists in donor-country universities, international centers and in Pakistan, and give administrative leadership and support and guidance to students when they are conducting their research in Pakistan.

ADMINISTRATION AND SUPPORT STAFF

Administration

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Project Director-- Expatriate Advisor (5 years)		-	750,000
				750,000

Support Staff

No.	Description	Grade*	Cost Rs.	Cost U.S. $
1	Adm. Assistant	G-12	60,000	-
1	Stenographer	G-11	45,000	-
1	Clerk (U.D.C.)	G-7	35,000	-
2	Drivers	G-5	50,000	-
2	Naib Qasid	G-1	28,000	-
			218,000	-

*G.O.P. Grade.

Summary Budget--Training

Project	--Training Program--- Degree	Short-term	---------Cost--------- Rs.	U.S. $
Dobari	-	5	250,000	20,000
Cotton-fallow	5	10	1,500,000	375,000
Kacha	-Estimate to be completed after feasibility study-			
Inoculum	-	1	25,000	5,000
Groundnuts	3	5	1,150,000	357,500
Machinery	2	2	350,000	145,000
Research Augmentation	5	10	1,000,000	400,000
Agricultural Economics	8	3	870,000	225,000
TOTAL	23	36	5,145,000	1,527,500

7. Budget Estimates, Donor and GOP

This budget includes only costs to administer the training coordination project and not the cost of all training as summarized in Section 6 above. The system used in budget formation and to estimate costs is presented in Sections "3. Organization," "4. Building" and "5. Equipment."

Summary Budget
(Five-Year)

Item	---------Cost--------- Rs.	U.S. $
Expatriate Long-term Project Director	-	750,000
Pakistani Support Staff	218,000	-
Equipment	520,000	30,000
Building Modifications	250,000	-
TOTAL	988,000	780,000

C. Policy Commentary

Policies on training need to be reviewed to ensure that participants return to Pakistan and make their contribution to advancing oilseed research and production.

Total

Description	Cost Rs.	Cost U.S. $
Administration		750,000
Support Staff	218,000	-
TOTAL	218,000	750,000

4. Building

The project would be housed in NARC where sufficient office and other working space should be provided. Any modification or improvement expenses to streamline operations would likely be paid from project funds. Therefore, Rs 250,000 is being budgeted to underwrite any facility modification.

5. Equipment Costs

Nonrecurring Expenses

Item	Cost Rs.	Cost U.S. $
2 Wagons or Broncos, right-hand drive	300,000	-
Office Equipment: furniture, typewriters, computer, calculator, visual aids, copier, etc.	150,000	25,000
Contingency Equipment (15%)	70,000	5,000
	520,000	30,000

6. Total Cost of Training (Five-Year Estimate)

These estimates include the cost of both short-term and degree training for all projects. They are broken down only to the project basis. There are no anticipated training costs within this project.

RESEARCH AND DEVELOPMENT OF OILSEED CROPS IN PAKISTAN

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This report deals with a traditional crop--rapeseed/mustard, and two nontraditional crops--sunflower and safflower. Industrial oil crops such as castor and linseed oil crops will not be dealt with here. Cotton has been excluded because it is grown primarily for lint and not for oil.

I. Rapeseed/Mustard (*Brassica* Species)

Two species of *Brassica* have been traditional crops in Pakistan for thousands of years. Most commonly grown in southern Pakistan, particularly on dobari lands (lands that grow rice during the summer), is *B juncea*. This plant is sometimes called mustard and is referred to locally as raya (sarson is misused as a name for it in much of Sind). More common in the north is rapeseed (*B campestris*), usually called sarson, which is a winter crop often sown with wheat.

A short season version of rapeseed is toria which is grown as a catch crop in the southern areas between a summer crop and wheat, and is sown in August/September and harvested in November/December. *B trilocularis*, often considered to be a subspecies of *B campestris*, and sometimes referred to as "yellow sarson," is grown on a small scale in northern Pakistan. *Eruca sativa*, called jambo in Sind and Baluchistan, and taramira elsewhere, is an ancient and widely grown crop in Pakistan, usually in areas marginal for crop production.

Collectively, the above species are by far the most important source of vegetable oil in Pakistan if cottonseed is excluded. As such, they deserve major attention in research and development programs nationwide.

The above species provide oils that have high levels of erucic acid and meals with high levels of the sulfur-containing glucosinolates. Because research has indicated that erucic acid has adverse effects on health, rapeseed oils containing erucic acid are banned as edible oils in Canada and several European countries. Glucosinolates, or their derivatives, are toxic when fed in large amounts to nonruminant animals--some glucosinolates provide the flavor of mustard condiments.

Canadian and European scientists have developed zero-erucic acid versions and very low glucosinolate versions of *B compestris*, referred to in Canada and England as turnip rape, and *B napus*, referred to as rapeseed or common rapeseed. Such versions are called double-zero types. The latter types of both species have been introduced to Pakistan; double-zero cultivators of *B campestris* are being increased and tested in areas of Pakistan traditionally growing that species during the winter. Double-zero versions of *B napus* are being tested and increased in the northern areas of Punjab Province and NWFP. If successfully established and maintained without admixtures of local types,

they will provide an oil similar to that from soybean and a meal with high protein and a good amino acid profile.

It is only a question of a short period o time until double-zero versions of B juncea become available. Australian researchers have already found two selections that are erucic acid-free which are now growing under test in Pakistan and being used in crosses to local cultivars. With several laboratories searching, it will not be long until low-glucosinolate or glucosinolate-free versions are found. When they become available, a concentrated research effort should be made to develop adapted cultivars of double-zero types of B juncea.

In the meantime, production research on B juncea should be stepped up, particularly in dobari areas and in riverine tracts. These are areas adjacent to rivers which are usually covered by water during the monsoon period and become dry enough for crop production during the winter. Locally, these areas are often called kacha tracts.

A. Research

NARC and provincial research institutes have research programs underway on Brassica species. These are variable in scope and quality and generally focus on types of cultivars adapted to the area of the research institute. Details of these research programs will not be given. However, priorities in research are in some cases not being given adequate consideration. They are as follows:

1. Evaluation of cultural practices for B juncea in dobari lands. In January 1983, thousands of acres of that species being grown in rice stubble of the Jacobabad-Sukkur-Larkana area were seen. It had been broadcast in the rice just as the water drained away. There were pure stands, but mostly it was mixed with other crops such as linseed or mutri (a low-growing, vine-type legume). Plant development was variable--poor plant growth apparently being a result of salinity or inadequate nutrition.

   The vast size and inefficient use of dobari lands dictage that they be given more attention as the location for B juncea. Research should established (a) the best choice of variety; (b) the best date of seeding relative to disappearance of the water under the rice; (c) optimum seeding rates; (d) benefits from applications of different amounts of plant nutrients; (e) benefits from supplemental irrigations where water is available; (f) adverse effects of pests and their control; (g) effects of associated species on performance; and (h) effects of the mustard on the following crop of rice.

2. **Development of adapted versions of double-zero** B juncea. The benefits of the double-zero type would be so important that the PARC/NARC should provide leadership in this undertaking, even to the extent of providing supplemental funding to the Pakistan Council for Scientific and Industrial Research (PCSIR), to obtain its cooperation in fatty acid and glucosinolate analyses. It would be highly desirable if the double-zero type had yellow seed, for this would aid in identifying and maintaining purity and probably would provide higher oil contents than brown-seeded types. (It is important that yellow-seeded and brown-seeded versions be compared for their performance in different environments.)

3. **Development of equipment to facilitate and improve production and harvest procedures.** This has a low priority because CIDA, focusing primarily on the barani areas, will probably develop equipment that will be usable in all areas of production. However, dobari soils are much heavier and more difficult to work than most barani soils.

4. **Development of a better off-station testing program.** This is a problem for all oilseed crops.

5. **Development of improved methods of aphid control.** The major pest of rapeseed/mustard is the aphid. It appears every year and causes particularly severe damage in late-sown crops. However, attacks vary from year to year. Research should establish (a) the role of predators in controlling infestation; (b) the optimum time and rate to apply insecticides; (c) the most effective insecticide that is safe to apply; and (iv) the potentials of plant resistance as a control.

6. **Measurement of hybrid vigor.** Anticipating that hybrid varieties will be available in the near future (A, B, and R lines of B juncea have been developed in India), it would be desirable to measure the performance of F1 hybrids now in comparison with the parents. Perhaps lines could be identified for future sterilization to form cytoplasmically male-sterile lines to serve as A-lines in the production of hybrid cultivars.

B. Crop Development

Because of the culture of at least one Brassica species in all areas of Pakistan, there will likely be little resistance to introducing changed, or improved, versions.

There is one major need. If and when superior double-zero cultivars of B juncea become available, they should be included among

the crops under supervision by GCP. With its supervision, maintenance of double-zero identity will be assured and pickup and transport of the seed to the appropriate processor will be accomplished.

II. Sunflower (*Helianthus annus*)

Sunflower is a crop that has been tested intermittently in Pakistan, and only recently has developed on a commercial scale. Results from both tests and commercial production have been variable, but on the whole, encouraging. Reasons for optimism are:

1. As in the U.S., cultivars have been adaptable to a wide range of environments. They can be grown as (i) a late fall-sown crop after rice or cotton in southern Sind Province; (ii) an early spring-sown crop between cotton crops in northern Sind and southern Punjab; and (iii) as a summer-sown crop in barani areas.

2. Some hybrid cultivars have given good yields (about 2,000 kg/ha, 20 md/a), and have shown little or no self-incompatibility, even when honey bees were scarce or absent. Hybrid cultivars that were tested are, Interstate 894, Sunbred 212 and Hi Sun 31 and 32.

3. Oil contents are high (40-50 percent), and with removal of the hulls (decorticated) the meal will have a high protein content (about 40 percent). The oil is of high quality both for direct use and for manufacture in vanaspati. The decorticated meal is slighly low in lysine, but of good quality otherwise. New sunflower processing plants in the U.S. use the hulls to provide enough energy to run the plant.

4. Diseases are of little consequence and insects have caused very little damage in Pakistan. In part, this is a consequence of the fact that sunflower is an introduced crop.

   One serious shortcoming of sunflower is its susceptibility to bird damage. However, experience from other countries indicates that where areas of production are large, damage to any one field has been small.

The U.S., Canada, many countries in Europe, Argentina, Australia and other countries are developing inbred lines for use in producing hybrid cultivars, either through single crosses or three-way crosses. They are being developed by many seed companies and a few public agencies.

The oil of sunflower is a premium cooking oil, so it should be acceptable for a wide range of edible uses in Pakistan. The fatty acid composition is approximately as follows:

Acid	Percent
linoleic	53
oleic	38
stearic	3
palmitic	6

Under high temperatures during seed filling, oleic acid contents will increase and under low temperatures, linoleic acid contents will increase. Recently, a genetic type has become available that will have 88 to 90 percent oleic acid and little or no linoleic acid. It should provide a premium cooking oil and be the best choice for Pakistan.

A. Research

Research on sunflower has been underway for several years in Pakistan, but it has been intermittent and often of poor quality. Developmental programs will benefit from much more sunflower research in rice and cotton areas where its culture can occupy the period of time between two crops. Research projects in order of priority are:

1. Identifying high-yielding hybrids to alternate with rice and cotton. A wide selection of hybrids should be made from different geographical regions.

2. Developing hybrid cultivars adapted to different areas of Pakistan. Developing such cultivars will require prior development and evaluation of male-fertile B-lines and their corresponding A-lines and fertility restoring R-lines. Major attention must be given to the maintenance of high levels of self-compatibility.

3. Identifying optimum dates for seeding. Because much of the sunflower acreage will be grown between rice or cotton crops, it is imperative that the seeding date be as early as possible. Furthermore, early plantings will advance flowering dates to avoid the very high temperatures and reduced levels of pollinating insects of the late spring.

4. Improving seedbed preparation and planting procedures. Even where germination percentage is high, sunflower stands are variable. Often, they are so thin or patchy that yields are seriously reduced. The objective should be to establish optimum stands with minimum

expenditure of energy and minimum loss of moisture from the surface layers of the soil. The use of line seeding in shallow furrows looks promising.

5. Identifying nutrient requirements for maximum net returns. In sunflower plantings there was evidence of nitrogen starvation in Pakistan, a consequence of deliberate efforts to grow the crop with minimum inputs. Banded applications close to the seed will probably be most effective, particularly for phosphorus.

6. Developing a better off-station testing program.

7. Developing better threshing equipment. Most countries growing large acreages of sunflower use combine harvesters with rasp-bar cylinders and concaves. Such cylinders and concaves rasp (or rub) the seeds from the heads with minimum damage to the head. Therefore, seed can be readily separated from the large fragments of the head.

   Peg-tooth cylinders and concaves, a feature of all locally-developed threshers for cereals, smash the sunflower head into small fragments which are difficult to separate from the seed. In addition, the peg-tooth cylinder and concaves are more damaging to the seed than rasp-bar types. A rasp-bar cylinder thresher must be developed if a sunflower seed-producing industry is to grow in Pakistan. The thresher should be simple in design, probably not too different from wheat threshers currently being used.

B. Crop Development

While sunflower acreages have been slowly increasing, some serious constraints have reduced grower acceptance. Listed below are some developments that will partly remove the constraints.

1. Use of locally grown seed of hybrid cultivars. An efficient local sunflower seed industry will provide less costly seed that will probably have better and more consistent germination than imported seed. Furthermore, it will require less time for delivery.

2. Correction of other constraints that apply to several crops include (a) concentration of acreages in selected areas; (b) improving methods of seedbed preparation and planting; (c) increased use and better placement of fertilizers; and (d) general use of improved threshers.

III. Safflower (Carthamum tinctorium)

Though considered here as a nontraditional crop, it is an ancient crop of the India/Pakistan area with its culture going back several hundred years. In south-central India (the Deccan) there are some one million acres with heavy soil where safflower is grown as a dryland rabi (winter) crop. In the Gujrat area of Pakistan it has been grown on a very small scale as a winter forage crop, usually as an admixture in wheat. Seed reported to be from locally grown varieties was seen in seed stores of Sind Province. In pansaris (stores selling curative herbs and roots) of many towns of Pakistan, the author found seeds of safflower back in 1958.

In areas with a Mediterranean climate (dry summers and wet winters), safflower has done well. These include Spain, Portugal, California, New Mexico and Chile. It is grown during the dry season on residual moisture in south-central India. Under humid conditions, safflower was susceptible to several leaf diseases, particularly during the flowering stage. These diseases include rust, Botrytis blight, Alternaria leaf spot, Ramularia leaf spot and Pseudomonas leaf blight.

Safflower has a relatively long growing period (a minimum of 120 days) which will restrict its culture between some summer crops in Pakistan. Research and experience from commercial plantings would indicate that it can be grown on dobari lands of Sind and southern Punjab Provinces between summer crops of rice if early maturing cultivars are grown. It probably will not fit in between crops of cotton.

In riverine (kacha) tracts which are flooded during the summer and dry during the winter, safflower should do well. Its deep root system would draw on residual moisture. If planted by early January, the crop should mature before the summer monsoon.

Safflower will probably not be competitive with wheat in barani areas of nothern Pakistan. However, the most serious weed of such barani areas is pohli (cathamum oxyacantha), which is very closely related to culviated safflower. In wheat, pohli remains in a rosette stage during much of the winter, but produces stems as the wheat matures, and after wheat harvest, will flower and produce seed.

Cathamum oxyacantha is wild, weedy and relatively widely distributed in Pakistan. Because it has been a crop of Asia for a very long period, there are many insects present that attack safflower. The black aphid is very serious in India and often in Pakistan. There are insects that attack the stem, the growing point and the developing head.

Birds are attracted to safflower as it matures, but not to the degree that they are to sunflower. In India, spiny cultivars are most resistant to attack than spineless cultivars. It is not

likely that birds will be a serious pest unless mature fields are left standing for long periods.

In all areas of the world where safflower is grown commercially as an oil crop, cultivars are spiny. Such cultivars, in comparison with those that are spineless, have had higher yields and higher oil contents. Spineless cultivars are widely grown in the Middle East where safflower is grown for the flowers which are harvested as they appear and then are dried.

In Pakistan, there has been strong farmer resistance to spiny types because of the discomfort that the spines cause at harvest. However, there are no spines on the lower leaves; the spininess progressively increases towards the top of the plant. The bracts (modified leves) around the heads are heavily spined and, in some spineless cultivars, may have very short spines. If dense and uniform stands can be achieved, branching (and heads) will be confined to the top of the plants. This permits hand harvesting with little discomfort. Cutting in the early morning when there is dew on the leaves reduces discomfort.

Two types of safflower are grown commercially in California. The standard, or high linoleic acid type, has oil with about the following fatty acid composition:

Acid	Percent
linoleic	78
oleic	15
stearic	2
palmitic	5

The high oleic acid type has the amounts of linoleic and oleic acids reversed from the standard type. The high linoleic acid (polyunsaturated) type is considered by some persons to reduce the incidence of atherosclerosis. On the other hand, the high oleic acid type is a much better cooking oil and has a longer shelf life, and so it should be the best choice for Pakistan. There is no evidence that it has an adverse effect on health.

A. Research

In the early stages of its development as a crop, safflower will probably be grown on dobari lands between crops of rice. Priorities have been established on that assumption. They are:

1. Seedbed preparation and stand establishment. Observations of commercial plantings of safflower after rice have indicated that the best stands were obtained where the seed was broadcast in the stubble just as the land came into condition for tillage. Then the land was

plowed twice. Another common method was to plow twice, then to broadcast the seed and follow with a third plowing. In all instances where the soil was heavy, the seedbed was extremely cloddy and stands were variable. Research should determine the following:

a. feasibility of planting safflower in standing rice as the water drains off--with and without soaking the seed;

b. the optimum type of equipment for working the soil before and after planting the seed;

c. responses to different plant spacings, i.e., different seeding rates;

d. the benefits of using line seedings; and

e. the optimum date of seeding.

2. Establishing the optimum amounts of different plant nutrients to apply. The appearance of commercial fields in 1983 would indicate that plants were suffering from a deficiency of nitrogen. Experience with safflower after rice in California would indicate that supplemental phosphorus banded on near the seed would be beneficial.

3. Where water is available, ascertaining the benefits of supplemental irrigations. Without good water management, crop irrigations will lead to severe damage from Phytophthora root rot.

4. Determining the effects of cutting back plants at different stages of development. One farmer had adopted the practice of "nipping" back safflower plants when they were about 40 cm high to a stub 15 to 20 cm long claiming that this stimulated branching and doubled yields.

5. Evaluating different methods of hand harvesting using both spiny and spineless cultivars.

6. Evaluating different designs for a thresher. A design that would also work for sunflower and soybean would be desirable.

7. Evaluating a wide range of cultivars. They should include both spiny and spineless types.

8. Developing a breeding program. It should be designed to provide a variety, or varieties, adapted to all dobari areas.

B. Crop Improvement

Essentially all of the commercial acreage of safflower is on dobari lands between crops of rice. In all cases, the land was of a heavy clay texture, evidenced by the very cloddy seed-beds produced by plowing. In most cases, stands were variable and, on an average, were thin. In no cases had fertilizer been applied, resulting in plants that were light green in color and delayed in development. Almost all the acreage was sown to Tori-78, a late-maturing, spineless cultivar. Crop development needs are as follows:

1. Expansion in research. It is extremely unfortunate that only a limited research base exists for the development of safflower on dobari lands. High priority research needs are outlined above.

2. Increased use of fertilizer. The GCP should develop strip tests in commercial plantings to demonstrate the response of safflower to nitrogen, phosphorus and to both together. Through PARC, a safflower maximization program is underway in Sind Province. The program is demonstrating the response of safflower to N and P, both individually and in combination.

3. Develop methods and/or use clothing and gloves that will permit hand harvesting of spiny cultivers with minimum discomfort.

4. Explore the use of the wheat thresher to thresh safflower. At reduced cylinder speeds, safflower seeds might be removed without damage. It should not be used for safflower that will be used as a source of seed for planting because of the possibility of reducing the germination percentage. Three projects are proposed as follows:

IV. Dobari Lands Project

The dobari lands are a resource that have not been fully exploited for oilseed crops. Such lands are used for rice during the summer and are often poorly used or left idle during the winter. Often, wheat cannot be grown because of the delay in preparing a seedbed. In the winter of 1983, there were thousands of acres of dobari lands sown to mustard (Brassica juncea) in the Larkana-Sukkur-Jacobabad area, often mixed with a low-growing legume (Lathyrus satiuus) and linseed. The benefits of winter culture of such crops on these lands are twofold: they will produce additional income and they will draw out the moisture

from the soil.

Three crops for major consideration are safflower, sunflower and rapeseed/mustard. The potential area that could be used to produce nontraditional oilseed crops is large. Rape/mustard will continue to be planted on much of this land. For example, it is expected that only about 30 percent of the dobari land will be devoted to the nontraditional oilseed crops. A sizeable portion of the remaining 70 percent will undoubtedly be devoted to rape and mustard. Without disrupting the present cropping patterns, the total potential output of the nontraditional oilseeds is estimated to be 3,441,500 metric tons.

A. Project Description

1. Objectives

- to identify the oilseed crops with the greatest potential;
- to identify cultivars with the most potential among the most promising crops;
- to identify optimum dates of seeding;
- to improve seedbed preparation, seed planting technology and harvesting and threshing procedures;
- to determine nutritional requirements;
- to determine optimum use of irrigation;
- to identify means of pest control; and
- to cooperate with extension workers and the GCP in the transfer of improved production technology to farmers.

2. Location and Institutions

The project would be headquartered at the Tandojam Agriculture Research Institute (TARI), but research would be conducted in three locations: south Sind, north Sind and south Punjab. Centers for research in those three areas will be identified later. There would be a strong component of off-station research and demonstration.

3. Tentative Personnel and Illustrative Budget

Administrative, Technical and Support Staff

Administrative: TARI

No.	Description	Grade*	--Cost for 5 Years-- Rs.	U.S.$
1	Project Director	G-20	200,000	
1	Deputy Project Director--Expatriate (5 Years)			750,000
0.25/Yr	Short-term Advisor			125,000
			200,000	875,000

Technical: TARI

1	Agricultural Engineer	G-19	160,000
1	Soil Chemist	G-19	130,000
1	Entomologist	G-18	130,000
1	Plant Pathologist	G-18	130,000
1	Agricultural Economist	G-18	130,000
5	Field Assistants (TARI off-station research)	G-11	225,000
1	Sunflower Botanist	G-18	130,000
1	Asst. Sunflower Botanist	G-17	115,000
2	Field Assistants (north Sind off-station research)	G-11	90,000
1	Safflower Agronomist	G-18	130,000
1	Rape/Mustard Agronomist	G-18	115,000
1	Asst. Sunflower Agronomist	G-17	115,000
1	Asst. Entomologist	G-17	115,000
1	Asst. Plant Pathologist	G-17	115,000
1	Asst. Agricultural Economist	G-17	115,000
6	Field Assistants	G-11	270,000
			2,230,000

*G.O.P. Grade.

Off-Station Research: South Punjab

No.	Description	Grade*	--Cost for 5 Years-- Rs.	U.S.$
1	Safflower Botanist	G-19	130,000	
1	Asst. Sunflower Agronomist	G 17	115,000	
1	Asst. Agricultural Economist	G-17	115,000	
3	Field Assistants	G-11	135,000	
			2,725,000	

Support Staff: All Units Combined

1	Administrative Asst.	G-11	45,000	
3	Stenographers	G-8	42,000	
1	Senior Clerk	G-6	35,000	
1	Junior Clerk	G-5	30,000	
3	Tractor Drivers	G-5	90,000	
5	Drivers	G-5	150,000	
2	Lab Assistants	G-1	80,000	
15	Beldars	G-1	225,000	
			697,000	

*G.O.P. Grade.

It is anticipated that the personnel of this project will be in addition to those already in place at TARI and at field stations. They should maintain their identity on the dobari project and focus their research effort strictly on dobari lands. The educational qualifications of personnel will not be described. However, because the project manager will be a key person on the project, he should have at least ten years' experience in research on safflower, sunflower and rapeseed/mustard, a history of successful off-station research on oilseeds and a knowledge of Sindi. The advisor on oilseeds should have experience with the same group of crops.

4. Allowances

Medical, R&R and housing is estimated to be about 25 percent of the salaries for Pakistani personnel, or Rs 900,000.

5. Nonrecurring Expenditures

These have not been allocated to stations, but would be approximately as follows:

Item	Rs.
4 Wagons for Project Manager and Advisor	1,200,000
3 Jeeps for Balance of Staff	300,000
7 M.C.	70,000
3 Tractors with Accessories	450,000
4 Power Sprayers	32,000
3 Threshers	60,000
Laboratory Equipment: balances, germinator incubators, moisture meter, etc.	200,000
Office Equipment: typewriter, photostat machine, furniture, etc.	120,000
	2,432,000

6. Travel Expenses

In Pakistan for advisors and Pakistani staff:

Per Year:	Rs 300,000
For Five Years:	Rs 1,500,000

7. Training

There should be a provision during the five-year period for five short-term, out-of-country study tours. Cost of these would be Rs 250,000 and U.S. $20,000.

8. Anticipated Total Expenditure

	Rs.	U.S.$
Personnel	3,622,000	875,000
Allowances	900,000	
Nonrecurring	2,432,000	
Travel	1,500,000	
Training	250,000	
	8,704,000	875,000

B. Measurement of Progress and Monitoring Results

The project manager should submit brief, quarterly reports on expenditures and progress of research to the steering committee. A detailed report of expenditures and accomplishments should be submitted to the steering committee annually. The committee should call a meeting to discuss both the annual report and plans for future work. Short-term consultants would be expected to submit reports evaluating progress.

C. Social and Economic Benefits and Constraints

If the project results in better economic use of dobari lands, there will probably be no adverse effects on local economies. If there is a substantial increase in production of oilseeds, disposal of oilseed meal and cake will present a problem.

D. Environmental Impact

Production of crops during the winter on dobari lands would improve the appearance of the agricultural landscape. Furthermore, such crops would pull down levels of moisture in the soil.

E. Policy Commentary

There should be strong local support for this project because it is generally realized that the dobari lands are, on average, inefficiently used during the winter.

V. Kacha (Riverine) Lands Project

Estimates of the amount of land covered by flood waters during the monsoon season and above water during the winter vary from one to two million hectares. How long the land is available for crop production undoubtedly varies with location and in different years. Unfortunately, there is no accurate assessment of the area from the point of view of its size, the quality of the soil for agriculture, the ownership of land and the durability of an area from one season to the next.

The kacha lands appear to have potential for oilseed crops, particularly those with deep roots and/or a short growing season. Candidates are rapeseed/mustard, sunflower and safflower. With present information, it is felt that a kacha project should be centered at the Agricultural Research Institute at D.I. Khan.

At this time, however, because of the lack of information on kacha lands, a feasibility study should be conducted that would

inquire into (a) the size and location of kacha lands; (b) the quality of the soil for agriculture; (c) the duration of the period when the land can be farmed; (d) ownership of the land; (e) present use of the land; (f) potential for the production of oilseed crops; and (g) locations for research and/or developmental programs.

A team making a feasibility study should consist of an agricultural economist, a soils scientist and an agronomist. A feasibility study should be established with a budget of around Rs 1,500,000 and U.S. $500,000.

VI. Seed Production Project

Briefly, the weaknesses of the present production and delivery system for high quality planting seed of oilseed crops are as follows:

- The introduction of large amounts of sunflower seed from abroad at high cost.
- Germination levels of both imported and local seed are often reduced by prolonged or improper storage and damage during harvest or elsewhere.
- Delays in delivery and receipt of planting seed, particularly from abroad, has delayed planting.
- The inability of public agencies to provide the seed for expanded programs.
- The technology of producing hybrid cultivars is not well known in Pakistan.

The first steps in the development of a planting seed industry in the private sector have been taken and more are likely in the future. As might be expected, the strongest interest is expressed in producing hybrid sunflower cultivars. Every effort should be made to encourage the development of a planting seed industry in the private sector. This should, in the initial stages at least, involve joint ventures by seed companies in Pakistan and other countries.

A. Anticipated Needs for Planting Seed

For the nontraditional crops, the needs for planting seed are given in Table 1, assuming that seeding rates will be 6 kg/ha for sunflower; 60 xg/ha for soybean; and 25 kg/ha for safflower.

Table 1

Needs for Nontraditional Oilseed Planting Seed
('000 Hectares)

	1984	1985	1986	1987	1988
Sunflower (hectares)	375	800	1,500	1,500	1,500
Sunflower (seed MT)	2,250	4,800	9,000	9,000	9,000
Soybean (hectares)	100	200	400	400	500
Soybean (seed MT)	6,000	1,200	2,400	2,400	3,000
Safflower (hectares)	250	300	750	750	750
Safflower (seed MT)	6,250	7,500	18,750	18,750	18,750

Areas required to produce planting seed, assuming yields of 800 kg/ha for sunflower, 1,200 kg/ha for soybean and 1,000 kg/ha for safflower are:

Table 2

Areas Needed for Nontraditional Oilseed Planting Seed
('000 Hectares)

	1984	1985	1986	1987	1988
Sunflower	2,813	6,000	11,250	11,250	11,250
Soybean	5,000	10,000	20,000	20,000	25,000
Safflower	6,250	7,500	18,750	18,750	18,750
TOTAL	14,063	23,500	50,000	50,000	55,000

B. Location for a Seed Industry

Northern areas of Pakistan and possibly high altitude areas of Baluchistan will be the best locations for planting seed production of sunflower and soybean. Thus far, planting seed production of safflower has been located in Sind Province. Northern areas provide the following advantages:

- Cooler temperatures during the seed filling period of growth which, in soybeans at least, results in high levels of germination.

- Larger populations of bees because of the presence of fruit and nut orchards. Honeybees are absolutely necessary in the production of hybrid cultivars of sunflower.

C. Project Description

1. Objectives

- To stimulate private sector involvement in the production of planting seed of oilseed crops.

- To train seedsmen who will own, or who will serve in, seed companies producing planting seed of oilseed crops. Training will be at all levels from managing field plantings to cleaning and processing seed.

- To expedite the development of facilities in the private sector for cleaning and processing planting seed of oilseed crops.

- To provide liaison with the foreign seed industry.

2. Operation

The project will achieve its objectives by two routes. The first will provide a training program for actual and potential seedsmen, and the second will provide several relatively small seed cleaners on credit with reasonable terms of repayment.

3. Location and Institutions

Inasmuch as the GCP has been assigned the task of developing acreages of nontraditional oilseed crops, the seed production project should be closely affiliated with that agency. It is expected that the GCP will provide office space and seed storage space both in the areas of seed production and seed use. The headquarters for the seed production units should be in Lahore.

4. Duration of the Project

The duration of the project will be three years, and since it is not intended that the project should continue after that period, a permanent administrative structure is not proposed.

5. Personnel

Two units are proposed, each will have an expatriate commercial seedsman and two Pakistani assistants. One unit will be provided with a secretary. They are:

Unit 1: Project Manager

An expatriate seedsman with production and processing experience in hybrid sunflower planting seed (mandatory) and experience in the production of planting seed of other crops. Pakistani assistants should have experience in research and/or commercial production of field crops.

Technical Personnel:	Rs.	U.S.$
Cost of seedsman for three years		450,000
Salary and allowances for two assistants (G-18), Rs 156,000 + 40,000	196,000	

Unit 2: Assistant Project Manager

An expatriate seedsman with production and processing experience with planting seed of wheat and hybrid corn.

Technical Personnel:	Rs.	U.S.$
Cost of seedsman for three years		450,000
Salary and allowances for two assistants (G-18), Rs 156,000 + 40,000	196,000	
TOTAL	392,000	900,000

Support Staff (three years):	Rs.	U.S.$
1 Administrative Assistant (G-11)	27,000	
1 Scenographer (G-8)	21,000	
2 Drivers (G-5)	36,000	
2 Beldars (G-1)	18,000	
Allowance for above (about 25 percent)	25,000	
	127,000	

6. Nonrecurring Costs

Item	Rs.	U.S.$
Vehicles:		
2 Four-wheel drive wagons or Bronco-type with right-hand drive	600,000	
Office equipment: typewriter, furniture, photostat machine, and other office equipment	120,000	
Seed Cleaners and Bag Closers:		
30 M38 small seed cleaners (Seedcure) complete with hopper, elevator, sack-off unit, full set of sizing screens and treater (if possible). Approximately $15,000 each F.O.B. plant (220 v, 50 cycle). Total cost with freight		540,000
30 Electric sewing bag closers with thread, material and service to be available in Pakistan. Approximately $400 each (220 v, 50 cycle)		12,000
	720,000	552,000

7. Travel Allowance

This allowance is for travel in Pakistan, exclusive of travel by car.

For advisors and Pakistani technical staff	100,000	300,000

8. Total Budget (Three Years)

Personnel, Salary and Allowances	392,000	900,000
Support Staff	127,000	
Nonrecurring Costs	720,000	552,000
Travel Allowance	300,000	
	1,539,000	1,452,000

D. Measurement of Progress and Monitoring Results

The project manager should submit brief, quarterly reports and a detailed annual report to the Steering Committee. There should be a meeting of the Steering Committee annually to review the report and evaluate plans for the future. The total annual production of planting seed will be a measure of success.

E. Social and Economic Benefits and Constraints

If successful, the short-term economic benefits will be substantial: Pakistan will be assured of an in-country supply of high quality seed for oilseed crops. Furthermore, it will provide an impetus to the development of a seed industry in the private sector that will serve other non-oilseed crops. It is also possible that introducing a viable seed industry to northern Pakistan will provide high income and rather labor intensive crops which could serve as a substitute for opium poppy.

F. Environmental Impact

The project is not expected to have any positive or negative effects on the environment.

G. Policy Commentary

The development of a viable seed industry which would spread to other crops, could open doors to joint ventures by Pakistani and foreign seed companies to the benefit of each country.

PART VI

THE LIVESTOCK AND POULTRY INDUSTRY

LIVESTOCK AND POULTRY PRODUCTION AND MARKETING

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6. Summary and Recommendations

1. Recommendations

a. Livestock and Livestock Products

- Begin a systematic reduction of livestock numbers by providing indemnity payments to livestock growers for culling and selling their less-productive animals. As a corollary, eliminate "meatless days."

- At the same time begin a massive forage and fodder development program aimed at adoption of higher-yielding fodder crop varieties, increased fertilizer use, increased grazing control of rangelands and application of other range improvement practices.

- Conduct an extensive milk production cost analysis for the major milking systems to provide a factual base for recommended changes in milk price regulations.

- Conduct feasibility studies of finishing male buffalo calves, draught animal culls and sheep for use in determining price levels required for profitable feeding.

- Establish livestock associations near feedlots, making maximum use of wastes and by-products, especially those of the sugar industry. Organize a separate multidisciplinary extension service for association members.

- Establish a demonstration unit on a government livestock farm and conduct feeding trials to demonstrate the value of oilseed by-products for feeding dairy and other cattle, buffalo calves and sheep.

- Provide technical expertise and support to the Department of Livestock and Dairy Development, Punjab, for developing a more effective genetic improvement program for dairy cattle and buffalo.

- Impose a graduated ceiling on milk powder imports or levy a sufficient tax on powder to subsidize the farm-gate price of milk.

- Set up a farm and livestock management survey unit to collect and analyze whole farm crop and livestock enterprise data for determining costs of production for use in planning at the individual farm and aggregate levels.

b. Poultry

- A program consisting of technical assistance, cooperative research and training abroad of poultry and farm managers should be started as a means of assisting the breeder, hatchery, broiler and egg production flock owners' increased output and income.

- Establish egg processing plants (perhaps as a joint venture) to utilize eggs during low demand periods. Similarly, develop a poultry-processing plant to meet the specialized needs of institutional consumers such as hotels, restaurants, hospitals, and the like.

- Develop official feed standards and laws/regulations establishing requirements for minimum nutrient levels included in each class of mixed feed.

- Initiate a program with the cooperation of commercial poultrymen and dairymen to demonstrate the feasibility of using poultry waste as an economic source of non-protein nitrogen.

- Develop a pilot program in urban areas where rendering plants exist to establish routes for collecting and assembling poultry wastes, meat processing wastes and dead bird disposals for rendering into useable meat meal by-products.

- With government assistance, develop a rural egg collecting system similar to present milk collecting schemes for bringing surplus eggs to market in good condition.

2. Description of the Study

The government's National Agricultural Policy stresses a balanced approach to all aspects of agriculture, including crops and livestock. Specialized oilseed crops are not grown extensively. Current domestic production of edible oils comes largely as a by-product of cotton production which is governed by the price of lint, not oil. Supply of edible oil, therefore, has not kept pace with the increasing demand, and imports have increased up to two-thirds of total consumption.

In response to this imbalance, the government has created an Oilseed Development Board to provide advice on growing and processing oilseed crops. An oilseed development plan has been prepared which proposes an expanded acreage of nontraditional oilseed crops (sunflowers, soybeans and safflowers), a gradual improvement in the yields of traditional oilseeds (rape and mustard) and improved extraction of edible oils through the rehabilitation of existing plants.

Success of the program will depend on (1) the price incentive for farmers to grow oilseeds and (2) an increase in oilseed production with no reduction in other essential crops. The latter will keep the edible oil problem from merely being transferred to another agricultural sector. Presumably, the program will proceed by introducing increased plantings of nontraditional oilseed crops on fallow land or incorporating these crops into rotations without reducing the acreage normally planted to the basic food crops.

Another aspect of an expanded edible oilseed program is the effect increased plantings of nontraditional oilseed crops may have on the area planted to forage crops. Already the supply of forage crops often falls short of needs for livstock feed. Unless cropping intensity ratios and yields can be increased, the supply of total feed produced could be reduced as oilseed crops are introduced.

On the positive side, additional supplies of sunflower, soybean, rape and mustard seed meal should be available for livestock and poultry feed as acreages and yields of these crops are increased, and larger proportions of the oil are extracted through the solvent process. Also, additional supplies of cottonseed meal could be forthcoming as the solvent extraction process is used rather than the expeller method of removing oil.

a. Objectives

With these discussions in mind, the objectives of this report are to (i) evaluate the potential for using edible oilseed crop by-products as a component of supplemental feed for livestock and poultry; and (ii) present project proposals for increasing the production of, and income from, improved qualities of livestock, poultry and their products. Possible funding sources for these proposals include government, donor or lending agencies and the private sector.

In reaching these objectives, considerable attention has been given to describing the present livestock and poultry production and marketing situation in Pakistan. Also, certain problems associated with current systems were carefully identified. These problems must be addressed if additional uses of inputs are to be effective and economical.

This report is based partly on extensive review of the latest available government and institutional statistics and publications concerning livestock and poultry production and marketing in Pakistan. It also reflects the insights gained from personal observation and discussion with people at government and private facilities during field trips to the four provinces.

3. Summary of Findings

a. Livestock and Livestock Products

Increases in total production of meat, milk and other livestock products in Pakistan over the past several years have resulted almost entirely from increases in livestock inventories rather than those in production per animal. Available supplies of forage from rangelands and natural pastures, fodder crops, crop residues and agro-industrial by-products fall far short of meeting the nutritive requirements of the current livestock inventory. However, no particular emphasis has been given to policies or programs to increase these feed supplies.

Despite numerous efforts, Pakistan's livestock sector lacks organized and reliable markets. In many instances, there are no adequate arrangements for collection, storage, transportation and retail sale of highly perishable commodities. Local municipalities and officials interfere in supply and demand by regulating prices of meat and milk. Prices set are below the cost of production for many producers.

Livestock in Pakistan is held for the most part in small herds. Many producers own no land and those who do have only small holdings. Primary emphasis in livestock production is on milk and traction, while beef is considered a by-product. Only among sheep and goat enterprises is primary emphasis given to meat. A large share of overall milk and meat production is consumed by the livestock holder's family.

The genetic level of milk-producing breeds is too low for efficient and economical production, and an adequate breeding system for sheep and goats has not been developed.

Milk processing plants lack sufficient volume of domestic milk to operate economically, while adding EEC-subsidized powdered milk to increase volume provides unfair price competition to domestic milk producers.

There is lack of an integrated extension approach to whole farm enterprises of production and marketing. Cost and return data for representative farm production sytems are needed to facilitate such an effort.

b. Poultry

Poultry and eggs are readily acceptable to consumers. To meet expected demand, there is a need to increase layers 1.8 times the present number and broilers 2.5 times. Protein and energy feed supplies should be increased accordingly.

Current levels of poultry management and disease control result in extremely high mortality rates--averaging 30 percent in commercial layers and 15 percent in broilers--indicating low

management levels.

The seasonal decline in egg consumption during summer months results in seasonal sell-offs and replacement of laying flocks. This creates price increases during high demand periods and consequent setting of poor quality eggs and hatching of poor quality chicks.

Lack of feed standards and inadequate laws or regulations governing feed quality results in feed of uncertain quality being sold to the poultry producer. The producer has no assurance of purchasing an adequate, balanced feed diet that is free of molds of aflatoxins.

Manure from some eight million commercial layers and eighteen million commercial broilers is not being used, nor are the viscera, blood, skin, feathers, etc., from poultry processing.

More than half the total poultry population of Pakistan is in rural flocks. Programs to increase egg production per bird by over three times appear to be succeeding. However, there is a consequent need to develop markets for these surplus eggs.

4. Issues

Several issues must be dealt with when making proposals for developing the livestock sector in Pakistan. The most important is the issue of just how interested the government is in the potential for moving the livestock sector toward a more efficient and commercial character, or whether livestock will remain subsistence enterprises--largely appendages to crop agriculture.

If programs are developed for improving the livestock sector and its forage resources, the level of success would depend largely on producer response to market prices. Key issues would concern the level to set product prices to effect improvement without undue costs to the average consumer. If price controls were removed completely, issues would immediately be raised concerning the ability of markets to translate demand and supply into equitable product prices.

Under current pricing levels of poultry and livestock products, the competition for scarce feeds favors the poultry industry. If the price of oilseed meals is based on the highest market value, livestock will be unable to compete with poultry for these high-protein supplements. The net effect may be even less total feed for livestock if oilseeds replace some of the traditional crops supplying the livestock industry. Therefore, the manner of pricing oilseed meals so it does not further aggravate this feed imbalance may become an issue.

Increasing oilseed crop production by offering incentives to producers could well cause it to compete with the production of food and forage crops. Food crop production aside, issues could arise concerning whether to allow oilseed crops to reduce the scarce forage supply or to what extent oilseed by-products compensate for loss of forage supply.

An issue revolves around whether high-protein oilseed meals from the extraction process should be priced on the international market and exported or on the domestic market and consumed. High-protein feed sources are vitally needed by the livestock and poultry industries to compensate for low-quality, low-protein domestic feeds. On the basis of long-term national interests, this issue should be looked at from a broad perspective--not just from that of the oilseed industry.

Balance of payments is not the only issue when viewing import-export balances. For powdered milk imports, an important issue is the level of imports to allow which will fill the current void without destroying opportunities to develop the domestic dairy industry.

The issues surrounding decisions by officials of whether to provide research and extension services to the livestock holders with sufficient resources to capitalize on new information, or whether the agencies should take a first-come-first-serve approach.

Issues will continue to arise about small landholdings and the limitations on most crop and livestock producers attempting to expand farm or herd size and become commercial operators.

B. Detailed Description: Economic Aspects of Livestock Production

1. Background

The government has for some time been concerned about the poor performance of livestock in relation to the ability of this large sector to produce sufficient quantities of meat and milk to satisfy the demand of Pakistan's increasing population. While the total food supply increased from the 1966-68 annual average of about 2,106 grams of calories, protein and fat per capita per day to 2,402 grams by 1979-80, the supply from animal products going into these average daily totals decreased from about 286 grams to 276 grams.[1]

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[1]The Food and Agriculture Organization of the United Nations (FAO), Production Yearbook, 1982.

The livestock sector is unable to keep pace in output with that of the crops sector. The livestock sector has indices of gross domestic product at constant factor cost increasing by only 56.5 percentage points from the 1959-60 base to 1979-80, compared with 134.1 and 135.5 percentage points for the major and minor crops, respectively, over the same period.[2] At the same time, the percentage share of livestock products in the gross domestic product has not changed, except for minor fluctuations between 1976 and 1981--the share in each year amounting to 9.2 percent. The same may be said of the crops sector in regard to changes in shares, although the percentage shares of both major and minor crops amounted to 21.9 percent in 1976 and 20 percent in 1981.

Despite reports that the government may be slow in developing effective and consistent plans for assisting livestock holders to increase output of milk, meat and other livestock products, the scope of the effort needed to move ahead may not be well understood by some critics. Provincial and federal officials in teaching, research or extension know the subtleties involved in the various livestock production systems and appear to be doing good work with the resources at hand. The government is assisting livestock producers, particularly in production, but perhaps less so in marketing. In marketing, retail prices of meat and milk are controlled and set by municipalities at levels lower than the few production cost reports available indicate.

However, the government's concern with performance of the livestock sector is being expressed in several ways. Livestock producers are exempt from income tax; imports of exotic breeding animals are allowed duty free; imports of machinery and equipment for the livestock industry (if not available in Pakistan) are duty free; artificial insemination of semen from proven sires and free veterinary treatment and disease control vaccinations are provided where possible. While the opportunity for potential benefits to a large number of livestock producers would be quite limited, the government allows livestock development projects, either privately operated or a joint venture, to export 50 percent of the new production created.

Another area of government concern is the establishment of more commercial livestock farms that could respond to market demands by incorporating better livestock and forage management practices into their enterprises. In the Punjab, some 110,000 acres of state land have been set aside for development of private livestock farms for farmers who are both interested and capable. In the Sind, some 112,000 acres of state land have been set aside for the same purpose. Also, to encourage larger and more commercialized livestock farmers, the ceilings on maximum-sized landholdings prescribed by land reform are being relaxed for farmers owning livestock.

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[2]Pakistan: Agricultural Data Book, June, 1982.

In marketing, local units of government are involved in processing milk and meat. Slaughterhouses operated by municipalities and opened by private butchers are by all reports outmoded, unhygienic and inefficient. Furthermore, offal and blood are not processed into livestock feed or other products. Much of the total livestock slaughter bypasses the slaughtering plants, although some of this is necessary, as many producers are too distant from the plants. Improvements have been proposed and even a modern slaughterhouse has been constructed; however, this plant, located in Karachi, has never been opened.

Milk plants are increasing in the private sector. The one in the public sector is in Lahore, and no plans appear to be laid for increasing the number of milk plants in the public sector. The future of milk processing, therefore, lies with the private sector. Private milk plants are now collecting 504,000 liters of milk per day--less than 10 percent of milk and milk product demand. Private milk plants are expected to expand capacity to 1,690,000 liters per day by 1985.

2. Current Status

The foregoing background discussion provides some basis for an examination of a few reasons why the livestock sector has not kept pace with the crops sector in applying better management and higher levels of inputs to secure higher production and income. This leads to an examination of livestock inventory changes and measures of production efficiency over the past several years, the structure of the livestock producing sector and the nature of the production processes.

a. Livestock Inventory and Production Changes

Livestock inventories for 1981 in Pakistan totalled 15.1 million cattle, 11.8 million buffalo, 29.5 million sheep and 32.8 million goats (see Table 1). While cattle increased only 3.4 percent between the 1969-71 average to 1981, buffalo increased 26.2 percent and sheep and goats 117.4 and 147.9 percent, respectively. Further, livestock products increased as indicated by 19 percent for beef, veal and buffalo meat, and by 133.7 percent for mutton, lamb and goat meat between 1969-71 and 1981. Milk production increased 6.2 percent for cows, 26.2 percent for buffalo, 85.7 percent for sheep and 149.2 percent for goats. As livestock numbers increased, the percent increases in production for wool, hides and skins closely paralleled those in livestock inventory numbers, as might be expected.

Table 1

Average Change in Livestock Inventory and Production of Livestock Products, 1969-71 and 1981 by Kind of Product and Livestock, Pakistan*

	1969-71	1981	Change (Percent)
	-1,000 Head-	-1,000 Head-	
Cattle	14,564	15,084	3.4
Buffalo	9,347	11,794	26.2
Sheep	13,096	28,468	117.4
Goats	13,233	32,808	147.9
	-1,000 MT-	-1,000 MT-	
Beef, Veal, Buffalo Meat	588	700	19.0
Mutton, Lamb, Goat Meat	291	680	133.7
Cow Milk	2,067	2,196	6.2
Buffalo Milk	5,169	6,519	26.1
Sheep Milk	21	39	85.7
Goat Milk	177	441	149.2
Wool	11,882	26,000	118.8
Cattle and Buffalo Hides	67,513	81,292	20.4
Sheepskins	15,168	32,943	116.9
Goatskins	15,687	38,886	147.9

*1981 FAO Production Yearbook, Vol. 35 (FAO Statistics Series No. 40), FAO/UNDP, Rome, 1982.

This pattern of increase also occurred with meat and milk, indicating increases in these critical products in Pakistan have come only through the addition of livestock numbers. In the case of milk, this pattern is more closely exhibited in Table 2 where the percent increases between 1979 and 1981 were almost the same for each kind of milking animal and the milk produced.

For both meat and milk these data are supported by the Agricultural Statistics of Pakistan, 1981, where hardly any change is noted in the carcass weights per animal slaughtered, nor for milk yields per animal subject to being milked. Such increases in production, coming as they do only from the addition of livestock numbers, places an additional strain on Pakistan's feed and forage resources and intensifies the competition between crops produced for livestock feed and crops grown for food.

Table 2

Average Change in Female Livestock
with Milking Potential and Milk Production
by Kind of Livestock, 1979 to 1981, Pakistan*

	1979	1981	Change (Percent)
	-1,000 Head-	-1,000 Head-	
Cows**	2,458	2,474	0.6
Buffalo**	3,817	3,981	4.3
Sheep***	15,463	18,202	17.7
Goats***	16,468	19,432	18.0
	-1,000 MT-	-1,000 MT-	
Cow Milk	2,183	2,194	0.6
Buffalo Milk	6,250	6,519	4.3
Sheep Milk	34	39	14.7
Goat Milk	374	441	17.9

*Pakistan: Agricultural Data Book, compiled by Ahmad M. Khalid, Agriculture and Rural Development Office, USAID Mission, Pakistan, June, 1982.

**Cows or buffalo three years of age and above in milk.

***Female sheep or goats one year of age and above.

According to figures on land use, no change has occurred in the five million acres of land in permanent pasture (range), although some increase occurred between 1969-71 and 1980 in permanent crops--not all of which may be cropland pasture (see Table 3). At the same time, the 10.8 percent increase in land irrigated probably had an effect on livestock forage and feed supplies in terms of green fodder and roughage grown and the by-products of other crops, including their residues. Otherwise, the increase forage required to support livestock at current levels of production would have come from increased amounts of straw and other by-products from increased acreages and yields of cultivated crops.

Table 3

Average Change in Land Use, 1969-71 to 1980
Pakistan*

	1969-71 (1,000 Hectares)	1980 (1,000 Hectares)	Change (Percent)
Total Area	80,394	80,394	0.0
Land Area	77,872	77,872	0.0
Arable and Permanent Crops:	19,282	20,320	5.4
Arable Land	19,119	20,030	4.8
Permanent Crops	163	290	77.9
Permanent Pasture	5,000	5,000	0.0
Forest and Woodland	2,465	2,800	13.6
Other Land	51,125	49,752	-2.7
Irrigated	(12,904)	(14,300)	(10.8)

*1981 FAO Production Yearbook, Vol. 35 (FAO Statistics Series No. 40), FAO/UNDP, Rome, 1982.

b. Structure of the Livestock Producing Sector

At this point it would be well to examine the structure of the livestock-producing industry and the way producers view production opportunities in the light of resources controlled. In the first place, over 90 percent of the households reporting cattle or buffalo in 1976 had one to six animals (see Table 4). These households held approximately three-fourths of the total cattle and buffalo production. Less than one percent of the households, or about three percent of the total population, had more than 21 of these animals.

Table 4

Proportions of Households Reporting and Proportions of Cattle and Buffalo by Herd Size, Pakistan, 1976

	Cattle		Buffalo	
Herd Size	Households	Cattle	Households	Buffalo
1 - 6 Animals	90.7	73.3	93.3	77.5
7 - 20 Animals	9.0	23.6	6.5	19.6
21 Animals and above	0.3	3.1	0.2	2.9

Source: Pakistan Census of Livestock, 1976, Agricultural Census Organization, Government of Pakistan.

Well over half the households reporting sheep in 1976 had one to five animals, while more than three-fourths of the households with goats reported the same number (see Table 5). Little more than 11 percent of Pakistan's sheep population was kept in this size herd, compared with one-third of the goats. Over 90 percent of the households reporting sheep or goats had 30 animals or less. The sheep-owning households had almost half the total sheep population, and the goat-owning households had about two-thirds. Over one-fifth the total sheep population was held by households with over 100 animals, although less than two percent of the households had herds of this size. A smaller proportion of households reported goats and goat numbers in this herd size. The larger herds of both sheep and goats were in the range areas of Baluchistan, Sind and the Northwest Frontier Province.

Table 5

Proportions of Households Reporting and Proportions of Sheep and Goats by Herd Size, Pakistan, 1976

	Sheep		Goats	
Herd Size	Households	Sheep	Households	Goats
1 - 5 Animals	59.6	11.7	78.6	31.2
6 - 30 Animals	31.3	34.8	18.6	35.6
31 - 100 Animals	7.4	31.0	2.4	21.2
101 Animals and above	1.7	22.5	0.4	12.2

Source: Pakistan Census of Livestock, 1976, Agricultural Census Organization, Government of Pakistan.

Not all livestock holders control land, as exhibited in Table 6. According to the 1976 Census of Livestock, over 23 percent of the households reporting cattle were classed as non-farm. This group held over 18 percent of the cattle population of Pakistan. The highest proportion of non-farm households reporting livestock had goats. Over 43 percent of these households held almost 37 percent of the goat population. Over one-third of the households reporting sheep were landless, owning about the same proportion of the total sheep population. While many of these non-farm households are nomads of transhumants, migrating with their herds in the range areas, many are sedentary and stay year-long, particularly in the cropping areas of the Sind, Northwest Frontier and the Punjab.

Table 6

Livestock in Non-Farm Households and Farm Households by Kind of Livestock, Pakistan, 1976

	Non-Farm Households (Percent)	Livestock (Percent)
Cattle	23.1	18.3
Buffalo	35.1	28.2
Sheep	33.7	33.9
Goats	43.4	36.7

Source: Pakistan Census of Livestock, 1976, Special Report, Agricultural Census Organization, Government of Pakistan.

The 1976 distributions of farm households reporting livestock in Pakistan and the total livestock on such farms by size of farm are listed in Table 7. The largest proportions of these farms are households that operated five to less than 25 acres, while the highest proportions of cattle, buffalo, sheep and goats also occurred in this farm-size category. The smallest proportion of farm households and livestock were found to be operating 25 acres or more.

Table 7

Proportion of Households with Livestock and the Total Number of Livestock, Pakistan, 1976

	Farm Households		
	Under 5 Acres	5 to Under 25 Acres	25 Acres and Above
Cattle:			
Households (%)	28.1	60.4	11.5
Cattle Nos. (%)	23.9	59.8	16.3
Buffalo:			
Households (%)	25.5	62.3	12.2
Buffalo Nos. (%)	18.6	62.9	18.5
Sheep:			
Households (%)	30.0	56.0	12.8
Sheep Nos. (%)	27.3	52.6	20.1
Goats:			
Households (%)	31.2	56.0	12.8
Goat Nos. (%)	33.2	50.2	16.6

Source: Pakistan Census of Livestock, 1976, Special Report, Agricultural Census Organization, Government of Pakistan.

These data document, in part, the rather large number of livestock producers having small herds and landholdings, if there is any land at all, and the difficulties encountered in developing effective research, extension and other programs capable of reaching significant proportions of these holders.

c. Livestock and Livestock Product Systems of Production

As illustrated previously, livestock and livestock product production in Pakistan are closely integrated with the rest of agriculture, for the majority of the households with livestock also have land. Livestock in most of these situations depend in varying degrees on forage crops and by-products from other crops produced, while these crops depend greatly on animal power for their planting and harvesting operations. An average of over 65 percent of total farm traction needs in crop production are furnished by livestock--primarily cattle.

Where livestock is confined for a time, manure is available for use as fertilizer on crops and as fuel for heating and cooking. In addition, portions of food crops, meat and milk produced on the farm are consumed by members of farm households and frequently are used in lieu of cash payments for hired labor. These degrees of integration are most highly pronounced in the Punjab, but also occur in cropping areas of other provinces.

At the same time, the dependence of livestock production on cropland agriculture among many non-farm livestock holders is quite apparent. Not owning land, many nomads, particularly in Baluchistan, graze their sheep and goats over rangelands. They move a great distance into cropland areas of Sind where their stock graze crop aftermath and their families find temporary work on farms in the area. Migrating herds are also found in the Northwest Frontier where there is a dependence on crop aftermath grazing to supplement range. Not to be overlooked are the landless livestock holders in heavily cropped areas who are more or less sedentary, although their livestock graze around such marginal areas as roadsides and canals. These herds also depend on crop aftermath grazing and purchased fodder and roughages. Some livestock herds, sheep and goats primarily, are herded over the range, seldom, if ever, grazing crop residues or being fed fodder or roughage.

Livestock production systems may be described further by emphasizing the multiple products produced. Among cattle and buffalo enterprises, the primary emphasis is on milk production and traction, with beef production considered a by-product of the milk-work scheme. At the same time, the milking herds raise calves, some of which go into the milking herd or are sold to other farmers. Some farmers raise draught animals either for their own use or sale, while others have only bullocks. Even draught cows may produce some milk, if only for home consumption.

At times, some milk cow breeds may be used for draught.

On the other hand, buffalo are kept primarily for milk production, although some male animals are kept for work on the farm. Female calves may be raised for herd replacement or sale, while many male buffalo calves, being unproductive, may be disposed of early. Except for these male calves--many slaughtered as vealers--the bulk of the country's beef production consists of animals culled for slaughter because of age or infirmities. This low-quality beef sells at lower prices than other meats and often is referred to as the "poor man's meat." Hides are used in the local tanning industry or exported.

Among sheep production systems, meat is the primary product, with male yearling lambs at a premium. Females usually are held for replacement. The remaining meat production is composed of cull breeding stock. Milk is of secondary importance to meat. It is used for home consumption, although some cheese may be sold. Wool production is a secondary activity. Wool is used primarily in the carpet-making industry with little emphasis being placed on crossbreeding for fine wool products used in the apparel industry.

Goats are held primarily for meat production, although milk production among some operators is important for home use. The milk goat is often referred to as the "poor man's cow." The rapid proliferation of meat breed goat numbers in recent years, however, signifies an increased emphasis on meat production. Goats are low producers of hair, thought of as a by-product--as is the skin; both are of value in the export trade.

For a more complete identification of livestock and livestock product production systems, attention may be given to the particular forage and feed enterprises that support animal production. Depending on the resources of the livestock holder, from one to several forage and feed enterprises may be available for the livestock system. These forage and feed enterprises may be classed as range and natural pasture, tame pasture, confinement feeding, supplemental feeding and crop residue grazing.

Listings of both livestock and forage and feed production systems appear in Table 8 for use as a guide in identifying the nature of the complete livestock production system. For instance, the buffalo colony being established outside Lahore and the Landhi Colony near Karachi may be identified as buffalo, under confinement, milk production systems. The feed consists of purchased green fodder, dry roughages and agro-industrial by-products. Replacements are purchased, not raised, and cull cows are sold for slaughter.

Table 5

Livestock, Forage and Feed Enterprises as a Basis for Identifying Livestock and Livestock Product System of Production in Pakistan

A. Livestock Enterprises

1. **Draught Cattle**
   a. Draught (primary)
   b. Raising replacements
   c. Beef (by-product)
   d. Milk (by-product)

2. **Milk Cows**
   a. Milk (primary)
   b. Raising replacements
   c. Beef (by-product)
   d. Draught (secondary)

3. **Buffalo**
   a. Milk (primary)
   b. Raising replacements
   c. Meat (by-product)
   d. Wool (secondary)

4. **Sheep**
   a. Meat (primary)
   b. Raising replacements
   c. Milk (secondary)
   d. Wool (secondary)

5. **Goats**
   a. Meats (primary)
   b. Raising replacements
   c. Milk (secondary)
   d. Hair (by-product)

B. Forage and Feed Enterprises

1. **Range and Natural Pasture**
   a. Year-long
   b. Seasonal

2. **Tame Pastures**
   a. Perennial
   b. Annual

3. **Confinement Feeding for Milk or Meat Production**
   a. Green fodder
   b. Dry roughages
   c. Agro-industrial by-products (oilseed cakes and meals, brans, molasses, sugarbeet pulp, baggasses
   d. Grain

4. **Supplementary Feeding for Milk, Meat Production or Draught**

   Same as 3.a-d above.

5. **Crop Residue Grazing**

As another example, a farmer may have a few cows for milk production that graze during the day on natural pastures nearby, and on crop residues following harvest of home-grown food crops. In addition, the cows are kept in a stall overnight and fed home-grown green fodder, dry roughages and purchased agro-industrial by-products. The farmer may use dry cows for draught. A large commercial-sized herd with the same characteristics would result in a larger proportion of the milk being sold and would likely be classified as a different system.

Another type of operation could be a farmer raising draught cattle for sale, the heifer for breeding and the bulls for draught. Cattle would graze seasonally on range and crop residues, with home-grown green fodder and roughages furnishing the balance of nutritional needs. The farmer could be using his own draught animals for crop operations, and returns from beef production would be forthcoming, mainly when an occasional animal becomes too old or too lame to work.

Sheep and goats are enterprises handled together or separately. In either case, a system of production would involve seasonal range grazing and grazing of crop residues after crop harvest. The primary product would be meat, although some milk could be taken for family use. Sales would be of grass-fed yearling lambs and kids, although some old or broken-mouthed breeding animals also would be sold. Sheep would be shorn once a year, perhaps twice, while goats would be shorn once a year or every other year. The same system could be found in the heavily cropped areas where the small stock would perhaps have access to seasonal grazing on natural pastures, crop residues and some purchased green fodder and roughages.

These, of course, are only a few of the livestock and livestock product systems that appear to exist in Pakistan. Additional refinements would be needed depending on herd size, combinations of livestock enterprises, total area cropped, the combination of crops grown together and a knowledge of cropping intensity ratios.

Thus, there are many livestock and livestock product producing systems with varying degrees of dependence on cropland agriculture and agro-industries to be considered when developing and promoting policies, plans and research and extension programs for increasing the efficiency of the livestock sector. If demands for multiple livestock products are to be met, and the livestock producer's well-being enhanced, the goals set by each type of producer relative to this system of production must be understood. Each head of a household engaged in livestock production, whether or not a farmer, must be considered a decision maker who will make production and marketing decisions that benefit his own household. The extent to which he responds to market or other incentives depends more on the importance he places on food, fuel and traction, relative to potential cash income earnings, than on the information he receives, including research findings.

In reviewing the background of the production of livestock and livestock products, certain strengths and weaknesses appear, some of which have been touched upon already.

3. Strengths

The main strengths of this large sector of agriculture lie in the provision of most of the draught power needed in crop production and the conversion of large quantities of forage and roughage, which otherwise would go unused, into valuable products such as meat, milk, wool, hair and hides and skins. Some 9.2 percent of the gross domestic product value came from the livestock section in 1981--almost one-third of the total agricultural output. Growth in total value of livestock products continues to occur by about four percent annually.

The high degree of diversification most livestock and crop producers practice, as reflected in the numerous production systems used, reduces much of the risk normally associated with single-enterprise operations. Losses from changes in weather, water availability and prices received, for instance, may affect one crop or livestock product enterprise, while part of this loss can be offset by production and income from another.

The government has made strides through research and extension services, artificial insemination stations, milk collection centers, veterinary services and other efforts in assisting livestock producers to improve their herds, maintain animal health and increase output of livestock products. Research results are subject to review by producers at research stations, and extension workers are in the field discussing with producers the results of trials and demonstrations.

4. Weaknesses

As pointed out earlier, the increase in livestock product output during the past few years has come about through the addition of more animals to the nation's inventory, while production of meat, milk and other products per animal has remained essentially the same. Meanwhile, with a human population growth approaching three pecent per year, the amount of calories, proteins and fats of animal origin available per capita for consumption is declining.

Further, as livestock inventories have increased, an additional burden has been placed on the supply of forage, fodder and feed resources nationwide. A recent estimate indicates that total digestible nutrients and digestible protein from green fodders, dry roughages, rangelands and agro-industrial by-products, on the average, are about two-thirds short of meeting the recommended maintenance requirements for the total livestock population of Pakistan.[3]

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[3]Mohammad Yaqoob Malik, Feed Resources for Livestock Production in Pakistan. XXVIII, Pakistan Science Conference, Multan, April 4-8, 1982.

Meanwhile, forage and fodder production methods in the country remain much as in the past. Few new forage crop varieties have been developed, and yields of existing crops have failed to improve. Industrial and agricultural wastes and by-products are not being fully utilized, and the possibilities for using molasses, bagasse, beet pulp, cottonseed hulls and fruit wastes frequently are not well understood.

Livestock numbers appear to far exceed the forage and feed base, despite the allocation of 20 to 25 percent of total cropped acreage to fodder crops. Rangelands over the country have been overstocked for years, and the rate continues to increase, leaving few opportunities for range improvement, increased forage production and protection against soil erosion.

According to most accounts, government policy is centered around the tradition of crop production, strengthened in recent years by the "Green Revolution." The main goal is self-sufficiency in food grains, and instruments of agrarian policy have been geared to support this goal. Prices for grain are at an attractive level, and inputs and storage are organized. Many factors of crop production are subsidized, and government has encouraged efforts to expand irrigation, production, provision of fertilizers, tubewell utilization and import of tractors.

In comparison, cattle and buffalo have long been neglected, except for use as a main source for draught power and a contributor to soil fertility. Apart from health services there are almost no subsidies. Producer prices have been so unattractive in the past that cattle and buffalo production remains at a low level of input intensity and is organized along subsistence lines. Compared with grain production, milk and meat production through cattle and buffalo certainly has not been commercialized.

These attitudes are reflected in government administration, which has a staff of well-trained extension workers. However, some extension personnel work with farmers on matters of crop production, while others are concerned with livestock production--primarily animal health matters. There is little coordination and no extension on the farm applied as an integrated system.

The bias toward crop production is further reflected in the lack of availability of statistical data on livestock. Except for the Pakistan Census of Livestock, 1976, data useful to policy makers, planners and others are missing in many key publications. With little commercialization in this sector, apparently there is little reason for smaller producers to see the need for these statistical series, despite the effects the lack of good information could have on government decisions.

This leads again to the bias toward crop production, founded in part by the influence grain and cash crop producers wield in obtaining government policies and programs according to their interests. As has been shown, livestock is mainly in the hands

of landless households and those with small to medium-sized landholdings. Lacking organization, these small holders have little influence on government prices.

Another weakness in Pakistan's livestock sector is the lack of organized and reliable markets. In many instances, there are no adequate arrangements for collection, storage, transportation and retail sale of highly perishable commodities, including meat and milk. This complicated marketing network leads to a piling up of market margins which reduces the producer's share of retail price profit margins. Compounding the problem is the practice among local municipalities and officials interfering in the processes of supply and demand without essential compensatory action.

As a result, prices received for milk, for instance, often are below the cost of green fodder, a condition which would worsen if labor and other costs were included. Beef, as a by-product of the work-milk scheme, cannot become a major product so long as prices are set below the cost of feeding. These low prices provide little incentive for the producer to increase production per animal. Rather, he likely will continue to hold a larger, though less productive, herd.

An offshoot of this problem is the lack of adequate cost of production studies on meat and milk, particularly for use by officials in setting prices of these products. Marketing boards normally take into account the views expressed by producers, extension and research workers, consumers and municipal authorities in arriving at fair prices. Aspersions can justifiably be cast on most budgets used in determining costs. There is a lack of uniform procedures in handling budget items for comparative purposes, particularly when the budgets may be constructed to represent different resource situations and production systems. Some budgets are enterprise-specific in nature--say a budget for estimating the cost of producing milk. Others are whole-farm budgets, the data of the cost of producing milk, for instance, being buried in the total budget.

Accounting procedures used are different, to say the least, with double counting of costs involved in some budgets, while others include only part of the costs such as livestock feed, and an item such as labor. In any event, there appears to be no regularly organized attempt by the government to collect farm management-type data from livestock producers, as is the case with cost budgets for major crops prepared by the Punjab Agricultural Research Coordinating Board and the University of Agriculture, Faisalabad.

Compared with crop farmers, livestock producers have little or no budget information to present in arguing for better product prices, rather than reorganizing their enterprises or changing input levels to increase their income. Such weaknesses, in both statistical and farm management data concerning livestock, also hamper the extension livestock and crop specialists in their work with farmers. Updated budgets specific to individual farm

conditions are powerful tools in initiating adoption of improved and profitable production techniques.

E. Major Impediments to Change/Progress

The most often cited impediment to progress in the livestock sector is the underdeveloped marketing system and the control of product prices at levels below the cost of production. Once the producer sees his returns rising above costs, he will exhibit more incentive in adopting practices that will further enhance his income. Price stimuli from a proportionate increase in producer price, relative to increased consumer price, will not alone secure an adequate supply of milk and meat.

Of all the people involved one way or the other in the livestock sector, probably the butchers and milk peddlers who have vested interests in the marketing system prefer most of all to keep things as they are. It must be remembered, however, that these groups deliver products to the consumer, perform worthwhile services and fill a marketing need which government policy and decision makers have so far not been inclined to consider.

Lack of a concerted effort to increase Pakistan's forage supply is another impediment to change, for little attention is given to high-yielding fodders, increased application of fertilizers, modern technology for the improvement of nutritive value of crop residues and proper utilization of agro-industrial by-products. Similarly, no large-scale national program has been developed for improving range and natural grassland. The emphasis by policy and decision makers has continued favoring food and cash crop agriculture over forage crops and livestock in developing plans and programs for assisting farmers and increasing production. Such programs would require large investments in an increased research and extension staff and in the expenses of sharing with farmers certain forage crop and range management inputs to achieve the desired results.

Government livestock administrators are veterinarians who occupy key posts and have been quite successful in defending their own interest groups. As a result, there is a shortage of non-veterinarian livestock specialists. Veterinarians are not livestock geneticists, economists, nutritionists, production management specialists, fodder agronomists or dairy technologists. A report has suggested that this constraint on manpower be eliminated by developing a manpower master plan for the livestock sector.[4] This plan would identify qualitatively and quantitatively future manpower requirements and implement them with expediency.

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[4]Dr. M. A. Saji and N. Jost, "Cattle and Buffalo Production and Current Constraints," Economics of Village Livestock, Punjab Research Institute, March, 1982.

At the same time, the report notes the insufficiency of the present institutional setup. There is no technically effective livestock production extension service, nor have the contents of an extension program been formulated. Since most livestock production is farm integrated, livestock development is stymied until livestock production and crop production extension activities are embraced in one extension service. These interdisciplinary efforts would be greatly enhanced if farm management and statistical data were available to the staff on an organized and consistent basis for use in working with livestock farmers and marketing groups.

Other impediments to change include the inadequacy of veterinary and breeding services due to lack of manpower, poor roads and lack of mobility, limited financial resources and other administrative and organizational restrictions. With all the veterinary and breeding services in Pakistan in the hands of the government, provisions allowing a step-up in private veterinary practice and placing more inoculation and disease control practices in the hands of livestock producers could alleviate some of these problems.

Of all the impediments to change, probably the most prominent is the fact that vast numbers of livestock holders have landholdings and herds so small that most of their livestock products are consumed by the household, and cattle are used for work with crops. A good part of livestock holders' land is devoted to fodder crops for livestock support. Entering the markets with only small amounts to sell, producers in this situation accumulate very little capital for expanding their operations. They receive scant attention from the overloaded extension workers and have little means for expecting much change, even if technical assistance were at hand. As a result, subsistent, low-input production systems continue.

6. Assessment of Priorities for Change

Before much can happen in getting the livestock sector moving, a change in the government's orientation toward crop agriculture must be modified to include equal emphasis on policies and programs affecting the livestock sector. The need for government to rethink the issues and to become more responsive to livestock production and marketing problems have been cited time and time again, and now the government is apparently prepared to respond. Difficulties are in assigning priorities, for so much needs doing, and in developing policies, programs and projects which are adequately funded for the task ahead.

The most needed change concerns the marketing system which needs upgrading and expanding. Modernizing slaughterhouses and milk plants and improving the milk collection and chilling system, including road construction and repair, are sorely needed. A change of policy regarding controls on meat and milk prices

should be part of the modernization and commercialization processes. Unless prices are allowed to reflect differences in quality, little or no effort will be made by the producer to increase output of higher quality livestock products and to otherwise respond to changes in consumer demand.

Of almost comparable importance is the need to move ahead with a concerted effort to increase Pakistan's forage supply. The same amount or more of the forage supply used in livestock production could be produced on less land by using improved fodder varieties, increasing fertilizer use, applying modern technology for improvement of nutritive value of crop residues and increasing use of agro-industrial by-products. The effort here would also include rangeland improvements, with success of both cropland and rangeland forage programs, depending on the government's ability and willingness to share with farmers the costs of initiating production practices. In addition, a stepped-up program of research and extension would be a "must" in getting new systems of forage production adopted by farmers.

Policy and program changes in the health care and breeding services provided by the government would appear to demand the next priority for change. While greater investments are needed in improved laboratories and the expansion of veterinary and animal breeding staff, a concerted effort might also be called for in transferring many of the more routine inoculation and health care programs from government to veterinarians in the private sector and to livestock holders themselves.

Another priority for change, which likely would be a part of the above proposals, is the expansion of a technically effective livestock production extension service and the promulgation of a more widespread extension program. Extension personnel would include representatives from all animal and crop production disciplines. The program should be designed to take an integrated crop-livestock whole farm approach to reflect the problems faced by the majority of farmers in the country.

Of lower priority, yet having a high potential for implementing favorable change in the livestock sector, is the initiation of cost of production studies for the various crop and livestock enterprises. These studies would be made on a continuing basis with attention paid to covering almost all the livestock and crop enterprises and their products in the country's major type of farming or land resource areas. Results of these studies would be used routinely by extension workers to help farmers develop plans to meet their goals. This activity also could be expected to supplement or enhance the program recently established by the Agricultural Prices Commission (APC) in recommending input and output prices to government.

Much difficulty would exist in actively trying to alter the structure and income-earning position of livestock producers in the country. Presumably, a move toward more commercialization among the numerous herd and land owners will occur. The

expansion of output and product marketing, hwever, will likely be vertical, with more product per animals or per acre, rather than horizontal, with more output and marketing from an expansion of farm herd size. The latter method would, of course, displace some farmers. Nevertheless, increased commercialization appears necessary if the livestock sector is to perform well in meeting the demands of Pakistan's population for livestock products. It should rank rather high in any set of priorities for change.

C. Suggested Project Analysis: Costs of Producing Crops and Livestock Products in Selected Land Resource Areas Pakistan

1. Technical Description

The primary objectives of this project would be to:

(a) Determine the costs of producing crops and livestock products for representative systems of production.

(b) Develop crop and livestock enterprise and whole farm budgets for use by extension service personnel with farm and non-farm holders of livestock. This will improve income and production, reduce risk and satisfy other goals.

(c) Provide government planners with crop and livestock enterprise and whole farm analyses. These analyses should indicate expected changes in income and production at individual and aggregate levels as a result of changes in policies, programs and projects affecting the livestock sector.

(d) Provide government with consistent and timely recommendations on crop and livestock input and output prices based on their effects on producer incomes, productivity and consumer prices.

(e) If successful, incorporate the above functions into regular government activities.

a. Study Methods

The method for reaching these objectives would be to conduct periodic farm and livestock management surveys in selected areas where information is collected periodically each year from a representative sample of farm and non-farm livestock holders. The data collected would include information concerning farm investment, organization, management practices, costs and returns. Care would be taken in recording physical inputs and outputs by month, with suitable methods of valuation being used

to estimate all costs and returns by crop and livestock product enterprise and by total farm or non-farm operation.

b. Data Collection

These farm and livestock survey data would be collected by enumerators living in the field and near the sample of farmers selected for participation. Preliminary testing of questionnaires and tabulation sheets to be used would indicate the frequency of visits to households. This would be related to the number of enterprises, the complexity of the relationships between them and the memory span of cost holders relative to answering detailed questions. Where appropriate, a farm record handbook would be developed for use by the holder in analyzing his farm and livestock enterprises for his own purposes. The handbook would also supply the enumerator with data necessary for satisfactory completion of the survey. Expectations suggest that two visits per week during the busy seasons of the year might be sufficient.

The number of enumerators required for such a project would depend on the number of areas to be covered with the survey, the size of the sample and the number of holders each enumerator could handle. Experience with "The Farm and Livestock Management Survey" conducted by the Ministry of Agriculture in Botswana indicates that among farm holders with both crop and livestock enterprises, one enumerator can handle about fifteen farmers while collecting data from each about twice a week during the busy season.

c. Data Analysis

Data collected would be subjected to computer analysis, using one of the farm management data analysis formats designed for this purpose, with modifications made to reflect the farming and livestock production situations in Pakistan. Enterprise and total farm budgets would be printed out for each farm/non-farm household and for averages of any set of budgets aggregated for many reasons. Common aggregations used could include averages of household farm budgets for a particular location--those of all enterprise budgets for a particular product and system of production; and those of high, middle and low producer budgets on the basis of value of output per livestock unit. Data collected would be used in additional models in dealing with estimates of the effects of changes in programs and policies.

d. Data Reporting

Each year, a summary of "Farm and Livestock Management Survey" results would be published for use by policy and decision makers and as a handy reference for monitoring the

economic well-being of crop and livestock producers in different resource situations. A useful practice for planning and evaluation with farm/non-farm holders is to give each an abbreviated version of his total farm and enterprise computer printout, show him the results of the average budgets in his particular area and discuss the reasons for differences in results. This would be a handy educational tool for extension workers.

e. Special Sampling Problems

Special sampling problems appear with planning such a project when the degree of coverage necessary to meet the objectives outlined is largely undetermined. Much would depend on how much representation is needed to get a handle on the main livestock and crop situation. It would also depend on the extent to which a new project should try to make some showing in each province simultaneously, as opposed to confining it, at least in the beginning, to the area of highest crop and livestock production--the Punjab. The project proposed here is assumed to be initiated in the Punjab with an eye to expanding to other provinces, as resources permit.

Appearances now indicate the desirability of dividing the Punjab into several land resource areas, with irrigated land, barani land, range areas and woodlands being a first approximation. On the basis of differences in weather, soils, vegetation and land use characteristics, there may be six to eight land resource areas in all. Sample villages and sample non-farm households could then be selected from lists prepared expressly for this purpose.

f. Staffing and Equipment

The project proposed would be directly under the Punjab Ministry of Agriculture, although close technical ties would be maintained with the Department of Research for both the Livestock Production Research Institute at Bhadanager and the Crops Research Group. In this situation, the project group, labeled the "Farm and Livestock Management Survey Unit," would be located with the Livestock Production Research Institute. The staff would be headed by a farm management economist experienced in both crops and livestock, a farm mangement economist (livestock), and a farm management economist (crops), all expatriates at the beginning. Each would have a local counterpart scientist who would receive training and experience, and who would soon take over their respective positions.

Allowances would be made for two expatriate consultants, one a specialist in sampling for agricultural statistical and farm management survey, and the other a computer programmer experienced in designing farm and livestock management survey and analysis programs. These consultants would serve for at least six months each.

First estimates indicate at least 15 villages and 15 farms per village should be included in the farm survey, while about 45 participants should be included in the non-farm livestock holder survey. The estimated 270 holders selected randomly would be interviewed throughout the year by about 18 field enumerators, classed as technicians and hired locally. Other local staff would include one senior secretary, two clerks, two keypunch operators, one store clerk, two chowkidars and one cleaner.

As the project expands, the most promising of the counterpart scientists and technical staff would be used as a cadre for setting up other farm and livestock management survey units in other provinces.

Building and equipment needs would include office space and equipment, field enumerator housing, motor scooters, trucks, supplies and housing for expatriate staff.

2. Benefits, Constraints and Economic and Environmental Effects

The benefits from this relatively small investment could be rather large. As more information concerning livestock and crop enterprises becomes available, better decisions can be made by individual farm and non-farm holders of livestock and by government policy and decision makers. Extension service personnel would have whole farm and crop and livestock enterprise budgets to assist farmers and stockmen evaluate the possibilities of adopting better levels of management and input use.

Working within the present system of agriculture, few social restraints should be encountered. Needs for farm and livestock costs and returns data would have to be explained, together with the necessity for farmer and stockman participation if reliable results are to be obtained. Confidentiality of interview data is paramount. Once the respondent is assured no one will use his data, other than project personnel, he likely will cooperate in good spirit.

Economic and environmental benefits could be quite large with this type of a project, although there would be difficulty in identifying benefits directly associated with project costs and those of running a farm and livestock management unit. Work of the unit would be part of the total research and extension program. The economic effect over time is expected to be positive and large. With improved levels of crop and livestock management, there would be positive environmental effects as well.

3. Administrative Feasibility

With plans for incorporation of a farm and livestock management unit into the provincial governments, the project appears quite feasible. Local officials have expressed the need for more economic expertise in dealing with crops and livestock, often citing the fact that few livestock economists exist in the country. Costs of running the unit would not be exorbitant.

D. Evaluation Plan

The project would be evaluated at all stages of development and as it continues. Sampling plans, questionnaries, interview techniques and computer programs would be reviewed with crop and livestock specialists in the Department of Research. Consultations would be held periodically with these staffs as surveys and analyses progress to uncover difficulties early. The Department of Extension would be brought in for exposure to the total project and data collection and analysis procedures to aid in their using the results with farmers. Results of cost of production studies would be presented to the Agricultural Prices Commission for use in making recommendations to the government about input and product pricing. Comments received from the APC, no doubt, would serve as a monitoring influence and another means of evaluation.

E. Implementation Plan

The project would be implemented and well underway by the end of the first year. The first year would be devoted to selecting the sample of farmers, hiring staff, designing and testing data collection methods and analysis through trial runs and making ready for full operation. The project would be at full strength the second year. As local counterpart scientists became trained and experienced, expatriate staff positions would be vacated, probably by the end of four to five years. The farm and livestock management survey unit would become an integral part of the Ministry of Agriculture, expanding at provincial levels and coordinating activities with the federal authorities.

F. Fiscal Plan

Professional Staff (Expatriate)	U.S.$ (1,000) Total	Year 1	Year 2	Year 3
Project Leader (Farm and Livestock Management)	600	150	150	150
Farm Management Economist (Livestock)	580	145	145	145
Farm Management Economist (Crops)	580	145	145	145
Consultant (Statistics)	150	75	75	0
Consultant (Computer Programming)	70	70	70	–
Counterpart Staff (Local)	–	–	–	–
Counterpart Scientists (3)	–	–	–	–
Enumerator Staff (Local, 18)	–	–	–	–
Clerks (Local, 2)	–	–	–	–
Keypunch Operators (Local, 2)	–	–	–	–
Others (Local, 3)	–	–	–	–
Training of Counterpart Staff	180	60	60	60
Minicomputers and Software	20	20	0	0
Trucks (3)	60	60	0	0
Houses, Furniture, Equipment	–	–	–	–
Expatriate Housing	–	–	–	–
Operating Expenses	–	–	–	–
TOTAL Donor Contribution	2,240	725	575	500

G. Policy Commentary

This project, aimed at the establishment of a farm and livestock management unit within the government has certain policy implications, although minor. Activities of concern to the project include, but by no means are limited to, determining costs of production for use by the GOP in setting prices. In this regard, the unit could well be held up to close scrutiny for legitimate reasons. It could find itself in difficulty, however, if doubt were cast on the reliability of results by those whose interests could be adversely affected by GOP decisions. Otherwise, the project and the unit itself should be viewed as a means of obtaining and analyzing data for policy decisions, constituting tools for implementing various policies.

DAIRY PRODUCTION AND MARKETING

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A. Summary and Recommendations

1. Recommendations

- Raise the farmgate milk price to enable farmers to cover average production costs and add an incentive margin to encourage surplus production.

- Reduce the number of unproductive cattle by rescinding the present "meatless days" and making indemnity payment to farmers for compulsory reduction in cattle numbers.

- Begin a massive forage and fodder development program aimed at adopting higher-yielding fodder crop varieties, increased fertilizer use, increased grazing control of rangelands and application of other range improvement practices.

- Conduct an extensive milk production cost analysis for the major milking systems to provide a factual base for recommended changes in milk price regulations. Conduct feasibility studies of finishing male buffalo calves, draught animal culls and sheep for use in determining price levels required for profitable feeding.

- Establish a demonstration unit on a government livestock farm and conduct feeding trials to demonstrate the value of oilseed by-products for feeding dairy and other cattle.

- Provide technical expertise and support to the Department of Livestock and Dairy Development, Punjab, for developing a more effective genetic improvement program for dairy cattle and buffalo.

- Impose a graduated ceiling on milk powder imports or levy a sufficient tax on powder to subsidize the farmgate price of milk.

2. Description of the Study

The government's national agricultural policy stresses a balanced approach to all aspects of agriculture, including crops and livestock. Specialized oilseed crops are not grown extensively. Current domestic production of edible oils comes largely as a by-product of cotton production which is governed by the price of lint, not oil. Supply of edible oil, therefore, has not kept pace with increasing demand, and imports have increased to two-thirds of the total consumption.

In response to this imbalance, the government has created an Oilseed Development Board to provide advice on growing and processing oilseed crops. An oilseed development plan has been

prepared which proposes an expanded acreage of nontraditional oilseed crops (sunflowers, soybeans and safflower), a gradual improvement in the yields of traditional oilseeds (rape and mustard) and improved extraction of edible oils through the rehabilitation of existing plants.

Success of the program will depend to a large extent on the pricing of both the oil and oilseed by-products, particularly relative to wheat, rice and sugarcane, and preventing significant displacement of these food crops. Presumably, the program will proceed by introducing increased plantings of nontraditional oilseed crops on fallowed land or incorporating these crops into rotations without reducing the acreage normally planted to the basic food crops.

An important element of expanding edible oilseed production and processing concerns the effect on the domestic livestock and poultry sectors. There should be additional supplies of sunflower, soybean, rape and mustard seed meal available for livestock and poultry feed as acreages of these crops are increased and larger proportions of the oil are extracted through the solvent process. Also, additional supplies of cottonseed meal could be forthcoming as the solvent extraction process is used, rather than the expeller method of removing oil.

Another aspect of an expanded edible oilseed program is the effect increased plantings of nontraditional oilseed crops may have on the area planted to forage crops. Already, the supply of forage crops often falls short of ner's for livestock feed. Unless cropping intensity ratios can be creased, there could be a reduction in the supply of total feed produced as oilseed crops are introduced.

a. Objectives

With these discussions in mind, the objectives of this report are to (i) evaluate the potential for using edible oilseed crop by-products as a component of supplemental feed for livestock and poultry; and (ii) present certain project proposals possible for funding by government, donor or lending agencies, or by the private sector for increasing the production of and income from improved qualities of livestock, poultry and their products. In reaching these objectives, considerable attention has been given to describing the present livestock and poultry production and marketing situation in Pakistan and to identifying problems associated with current systems. These problems must be addressed if additional uses of inputs are to be effective and economical.

This report is based partly on extensive review of the latest available government and institutional statistics and publications concerning livestock and poultry production and marketing in Pakistan. The report also reflects the insights gained from personal observations and discussions with people at government,

institutional and private facilities during field trips to the four provinces.

B. Detailed Description

1. Background of Milk Production and Marketing

Keeping cattle and water buffalo has been a family tradition in Pakistan since the early Indus Valley civilization of 2500 B.C. In early times, these animals not only supplied the family with milk and meat, but were the primary source of traction for farming and transportation. The specialized production of milk or meat on a commercial scale had not been established. Therefore, the number of cattle/buffalo per herd remained small and traditionally limited to the milk, meat and traction needs of individual family owners.

Because no direct cash income was generated from these animals, the purchase of feeds was minimal. Likewise, to allocate land to fodder crops would reduce income from cash crops. Thus, it has been a well-established tradition to feed low-quality refuse and by-products from cash crops to cattle and buffalo. Consequently, the level of milk and meat production per animal has always been low.

Total milk production in Pakistan has been relatively high due to the large number of cattle and buffalo, but poor distribution into central urban centers has been a public concern. In general, the small herd size and low productivity per animal has limited the development of any coordinated milk market.

As the population in urban centers expanded, the commercial demand for fresh milk gave rise to many herds of cattle and buffalo being located within city areas. This led to the development of a direct producer-consumer raw milk market as a partial answer to supplying urban consumers. The market brought problems of poor sanitation, adulterated milk and inadequate feed supply. The best solution appeared to be keeping the cattle/buffalo confined to rural areas and developing milk collection stations and central processing plants to move the milk to urban centers. Concurrently, government retail prices were imposed on processed milk for consumer protection.

Unfortunately, the controlled retail price did not allow sufficient margin to cover collection and processing costs plus a reasonable return to milk producers. With no financial incentive for farmers to supply this market, milk processing plants could not attract the volume necessary to operate on an efficient scale. Out of 20 plants established solely for processing domestically produced milk, 17 are operating.

The lack of financial incentives for farmers to produce milk on a commercial scale has delayed the adoption of improved herd

management practices requiring investments or higher operating costs. Thus, there has been no significant development toward improved efficiency or higher milk yields per animal at the private farm level. The most notable government-sponsored program has been the upgrading of native non-descript cattle through artificial insemination to Holstein/Friesian sires. First-generation female progeny from this cross produce higher milk yields than the traditional Pakistani purebreds. Other government livestock programs have focused primarily on disease control.

Only five percent of the national milk production is derived from goats and sheep. No significant quantity of their milk enters the commercial market. Most goat and sheep herds are kept for wool and meat production as cash income, and any surplus milk is consumed by the family. Thus, no attempt has been made to incorporate these species into this study.

2. Current Status

a. National Population and Distribution of Cattle/Buffalo

The most recent estimate of total cattle and buffalo (1980-81) was 15.1 and 11.8 million head, respectively. Table 1 gives a detailed view of these animals by age and sex.

Table 1

Estimated Population of Cattle and Buffalo

	Cattle	Buffalo
No. of females 3 years and over	4,717,000	6,686,000
No. of females less than 3 years	1,972,000	3,111,000
No. of males	8,394,000	1,997,000
TOTAL	15,083,000	11,794,000

Source: Pakistan Agriculture Data Book, June, 1982.

Even though there are more cattle than buffalo in Pakistan, only 44 percent of the cattle population is composed of females, compared with 83 percent of the buffalo population. The 1976 census of livestock shows 80.6 percent of total animal traction is provided by male cattle, compared with 2.3 percent by male buffalo, accounting for the disproportionate ratio of males to females among cattle.

Only 52 percent of female cattle over three years old were actually producing milk on the day of the 1976 enumeration because 40 percent were dry and eight percent were never calved. A similar situation was indicated for the female buffalo over three years old, with 59.5 percent milking, 28.5 percent dry and 12 percent unfreshened. A normal breeding and management goal would be 80 percent producing milk at all times. The high percent of nonproducing females in Pakistan significantly increases overhead costs and markedly decreases the average production per animal. Table 2 shows a comparison of daily production calculated on the basis of all females over three years old, versus only those in lactation.

Table 2

Daily Milk Production by Females Over Three Years Old

	Cattle Average Liters/Day	Buffalo Average Liters/Day
Females in lactation	3.55	5.37
All females over 3 years old	1.85	3.20

The predominant position of Punjab Province in numbers of cattle, buffalo and people shows the importance of focusing dairy project activities to this area for the greatest effect (Table 3).

Table 3

Distribution of Cattle/Buffalo Females Over Three Years Old and Human Population

Province	Cattle	--%--	Buffalo	--%--	Human	--%--	Cattle/Buffalo:People
Punjab	2,189,936	53.6	4,399,975	73.9	47.45	56.6	1: 7.2
Sind	907,381	22.2	1,146,847	19.3	10.97	22.6	1: 9.2
Baluchistan	205,022	5.0	21,205	0.4	4.31	5.1	1:19.0
NWFP	783,311	19.2	383,768	6.4	13.06	15.7	1:11.3
TOTAL	4,085,650		5,951,795		83.79		1: 8.3

Source: "Pakistan Census of Livestock, 1976" (Special Paper) and Housing and Population Census of Pakistan, 1980-81.

The distribution of cattle/buffalo populations by herd size is another important factor to consider when designing projects to improve production or marketing. Table 4 illustrates the distribution of cattle and buffalo by number of animals per herd in 1976.

Table 4

Distribution of Cattle and Buffaloes by Herd Size

No. of Animals per Herd	Cattle		Buffalo	
	# of Herds	% of Total	# of Herds	% of Total
Less than 5	3,155,038	77.62	2,871,576	83.60
5 - 10	821,535	20.21	503,483	14.66
11 - 20	76,999	1.89	51,533	1.50
21 - 50	10,372	0.26	7,266	0.21
More than 50	1,004	0.02	927	0.03

Source: Derived from "Pakistan Census of Livestock, 1976."

Based on the 1976 census of households owning cattle or buffalo, the average herd size was 3.47 cattle and 3.07 buffalo. These figures do not separate out the animals used for animal traction or indicate the duplication of households owning both cattle and buffalo. Even so, it is evident that small herds of less than five animals are most characteristic of cattle/buffalo herds in Pakistan.

Much can be said about the beneficial features of small herds in family employment and utilization of scavenger-type feeds. Milk collection and marketing problems, however, become compounded from small-volume handling. For example, 132 dairy cooperatives have been established in Sahiwal and Sargodha Districts of the Punjab Province by the Department of Livestock and Dairy Development.[1] Only 11,000 liters of milk are collected daily. This calculates to a mere 83.3 liters per cooperative.

b. National Milk Production, Availability and Consumption

Total milk production in Pakistan is high, relative to many other countries, due to the large population of cattle and buffalo. However, nearly 20 percent of the milk

[1] Pakistan Economic Survey, 1980-81.

produced is either wasted or consumed by suckling progeny. Table 5 shows annual milk production and its availability for consumption.

Table 5

Annual Milk Production and Availability
(1,000 Metric Tons)

	1971-72	1975-76	1979-80	Percent Change 1971-79
Milk Produced	7,758	8,348	9,014	+16.2
Milk Available for Consumption	6,253	6,742	7,299	+16.7

The nine million tons of milk produced in Pakistan in 1979-80 was 38 percent more than that of all the OPEC countries put together. It represents about one-half the quantity of milk produced in all 50 countries of the Muslim world.[2] Even so, the per capita availability of milk and milk products has fallen from around 150-160 kg in 1960-65, to 118-120 kg in 1970-75 and to 88-91 kg in 1977-78. Between 1972 and 1978, milk production was estimated to have increased by 10 percent, while the human population and its availability have not kept pace with human population growth.

It is assumed that sufficient quantities of milk and milk products are readily available in the 4.8 million households that keep cattle and buffalo. However, the distribution system for supplying the people living in urban areas is insufficient. The increasing urban demand for milk is enhanced by migration from rural areas. Urban families tend to be larger and their incomes greater.

The failure of milk production to keep pace with urban demand and an inadequate marketing system to move the milk from producers to cities creates a growing trend for urban consumers to accept the readily available supply of duty free, imported milk powder. Restricting retail prices on milk by government decree imposes low prices on the producer and removes the incentive to increase domestic production. Milk processing plants are now being developed to utilize the highly subsidized European Economic Community (EEC) milk powder and take advantage of the urban consumer's demand.

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[2]Saeed Ahmad Qureshi, Livestock Development Potential and Strategy in Pakistan, Planning and Development Board, Punjab.

c. Current Positive Factors Which Favor Milk Production and Marketing

(1) Milk Production

Certain resources and special government programs are already present that should be recognized for the potential contribution toward future self-sufficiency in milk production:

a. Cattle and buffalo population. There are already over 11 million cattle and buffalo females of milk-producing age in Pakistan. If annual production per head could be increased to an average of 2,000 liters, only 5.236 million head would be needed to provide 100 liters per capita to the present human population, plus 400 liters to carry each calf to weaning age. In other words, there are twice as many cattle/buffalo females as are actually needed for self-sufficiency.

b. Availability and cost of labor. About 72 percent of the national population lives in rural areas, and 56 percent of the labor force is employed in agriculture. Also, 4.8 million families own cattle or buffalo. Thus, there is adequate availability of labor experienced in handling dairy animals. The current wage scale for farm labor is less than 15 rupees/day (1.20 U.S. dollars).

c. Artificial insemination (AI). Established in 1972, the government artificial insemination service inseminates over 175,000 animals per year. In Punjab Province, there are 90 centers with 173 subcenters employing 377 AI technicians. The genetic goal is to improve purebreds through intensive selection and cross nondescript cows with Friesian and Jersey sires.

d. Veterinary service. Disease control has received more government emphasis and support than any other livestock program. Veterinary centers are located throughout the dairy sector.

(2) Milk Marketing

a. Consumer demand. The number one prerequisite to developing a market is consumer demand. The plus four percent annual growth rate in urban population has created a demand for milk and dairy products that is greater than the present marketing system can supply.

b. Milk collection and chilling stations. Significant progress is being made in establishing a large network

of collection and chilling stations, especially in Punjab Province. These collection stations are being established at the village level for pooling milk from countless small herds. Milk is then collected in bulk and pumped through a plate cooler at a nearby chilling station before delivery at a central milk processing plant.

d. Current Negative Factors Influencing Milk Production and Marketing

Many constraints are seriously limiting progress in the dairy sector. Those of primary importance are listed as follows:

(1) No Profit Incentive for Commercial Milk Production

The retail price of milk that reaches the consumer through commercial processing and marketing channels is restricted by government decree.[3] The price received by the producer is not government regulated. Therefore, the farm price is dictated by subtracting all costs of milk collection, processing-packaging and marketing. These costs can amount to over 60 percent of the retail price due to the cost of small-volume handling. The net result is a farm price too low to cover the costs of production. Therefore, no incentive is provided for farmers to increase their milk sales. An example of price differential between collection station and retail is shown below.

Table 6

Price Per Liter of Milk
(Rupees)

	4.0 Percent -Butterfat-	3.5 percent -Butterfat-
Collection Station	1.51	
Retail		4.13

Sources: Karawala Village Collection Station, November, 1982, and Pakistan Economic Survey, 1981-82, Ministry of Finance.

[3]D.H.L. Rollinson (FAO Chief Livestock Development Advisor), A Summary of the Current Situation of the Import of Milk and Milk Products into Pakistan, 1979.

(2) Dairy Feed Rations are Inadequate

Adequate supplies of good-quality forage are the foundation for efficient production of milk. As milk yields increase, supplementation of grain concentrates becomes necessary. In Pakistan, green fodders are the most important feed consumed by cattle/buffalo. Although 16 percent of the total cultivated land is devoted to producing greed fodder,[4] the supply is insufficient to meet the requirements of the increasing number of livestock. Therefore, dry roughages from cereal crop residues such as straw and stovers make up the balance of available forage.

Agro-industrial by-products are being heavily utilized as the only "concentrates" to supplement the forages. These are primarily cakes and meals from oilseed processing, brans from wheat and rice milling and molasses and beet pulp from the processing of sugarcanes and sugar beets. Taking into consideration all feed resources available to livestock in Pakistan, they provide only 36.5 percent of the energy and 33.25 percent of the protein recommended for body weight maintenance of the present livestock population.[5] The lack of feed and its low quality are considered the primary causes for the low productivity of Pakistani cattle and buffalo. Also, much of the animal health and reproduction problems can be traced directly to nutritional deficiencies.

(3) Low Genetic Level of Cattle and Buffalo

The necessary components of a genetic improvement program for milk yields are (i) an extensive animal identification system in which animals are tagged with a nonduplicated number series; (ii) a production-testing record system to measure individual performance over an extended time period; (iii) development of performance standards for selecting superior individuals; and (iv) a breeding system such as artificial insemination which favors the multiplication of progeny from the selected animals.

These components for genetic improvement have been virtually nonexistent in Pakistan until just recently. The latest reference[6] indicates only 22,000 animals have been ear-tagged and 1,000 have been production tested. Production testing is limited

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[4]Mohammad Yaqoob Malik, Feed Resources for Livestock Production in Pakistan, Pakistan Science Conference, April, 1982.

[5]S. B. Ali Shah, Development of Dairying in NWFP, Bd.Ec.Eq., Pub. No. 101, University of Peshawar, 1975.

[6]Department of Livestock and Dairy Development, A Fictorial View of Livestock and Dairy Development, Punjab.

only to government and military livestock farms. AT this time, a strict breeding policy is being followed in which the domestic purebreds shall be kept pure by breeding only to sires of the same breed. Thus, a genetic program to improve the productivity of these breeds will be delayed until all the necessary components listed above are functioning intensively.

The greatest opportunity to make significant progress in cattle productivity comes from the accepted policy of breeding non-descript indigenous cows with Holstein/Friesian sires. The Holstein sires are the product of well-established genetic improvement programs in the United States. The results thus far indicate the age at maturity is reduced 12 to 18 months and milk yields are increased 100 to 140 percent.

Higher genetics mean less animals will be needed to meet national production goals, placing less stress on limited feed supplies. Higher yields per animal unit also reduces production costs and puts the herd owner in a better economic position.

(4) Extension Education for Milk Producers

In the past, the educational needs of milk producers were completely ignored by the government for what may have been provided by veterinarians. No education was provided for improving herd management practices and economic decision making. More recently, a Livestock Production (Extension) Service has been established in Punjab Province by the Department of Livestock and Dairy Development.[7] Its program activities appear to be heavily oriented toward service which may detract from emphasis on education.

The most encouraging educational program observed was the training center operated by the Punjab Livestock Project at Sheikhupura. This center was staffed by a farm management specialist, veterinary officer, artificial insemination officer and a dairy products technician directed by a team leader. Its educational program was tied to village milk collection stations.

Two primary obstacles seriously limit the effectiveness of extension educational programs for milk producers. The first and most serious is the lack of a financial incentive for producers to adopt any practice requiring a cash expenditure. No matter how efficient or productive the farmer becomes, the low milk price will not cover his cost of production. The milk price received per liter of four percent butterfat milk at Rs 1.51 is equivalent to $5.50 per 100 pounds. For comparison, the present U.S. government support price for 3.5 percent butterfat milk is $13.20 per 100 pounds.

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[7] *Ibid.*

The second obstacle limiting the educational approach is the extremely low literacy rate (14.3 percent) in rural areas. This especially limits the teaching of basic principles through the written media, leaving open only the educational technique of "how to do it" demonstration methods.

There is a lack of trained personnel to staff a nationwide extension dairy program because there is no university in Pakistan with a dairy department or a specialized curriculum of dairy science courses.

(5) Small Herd Size and Milk Collection

The 1976 livestock census showed an average herd size of 3.47 cattle or 3.07 buffaloes. These figures include males and young stock. As only 31 percent of the cattle population and 57 percent of the buffalo population are made up of females three years or older, the average herd contains only 1.1 cows or 1.75 buffaloes of milk-producing age. Considering the average daily milk yield of cows is 1.85 liters and the average daily yield of buffaloes is 3.2 liters, it is obvious that the average cow or buffalo herd produces mo milk for sale. Milk would all be consumed on the farm. Only herds with more than 10 animals produce enough milk to justify collection for commercial processing. In 1976, 2.2 percent of the cattle herds and 1.7 percent of the buffalo herds fell into this category (Table 4).

The low milk price paid to farmers at collection stations does not attract much milk from the larger herds. The larger herd owners specializing in milk production sell their milk directly to consumers or intermediaries at a price closely equivalent to the established retail level. The intermediaries operate on a margin obtained by water dilution.[29]

Seasonal variation in milk production is especially noted in small herds. They are very unlikely to have stored feed reserves and are therefore more vulnerable to seasonal feed shortages. The variation in milk supply at the Gujranwala Village Collection Station ranged from 100 to 500 liters between seasons.

In summary, the collection of milk for commercial processing is besieged with problems of low and fluctuating volumes. All these problems add significantly to marketing costs and, consequently, lower the price paid to producers.

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[29]S. B. Ali Shah, *op. cit.*

(6) Imported Milk Powder

To increase the availability of milk to urban centers, imported milk powder and other dairy products have made their way into the market. The increased use of these products is shown below.

Table 7

Value of Imported Dairy Products

	Year					
	1974	1975	1976	1977	1978	1979-80
Value	16.8	15.2	33.5	36.7	26.8	32.6

Sources: D.H.L. Rollinson, *op. cit.*, and Economics of Village Livestock, 1981, Economic Research Institute, Punjab, p. 187.

The present cost of imported nonfat milk powder when reconstituted with water is Rs 1.7 per liter.[9] There are several large milk processing plants being developed to blend this cheap reconstituted nonfat milk with high testing domestic milk. Because there is an unlimited supply of heavily subsidized milk powder available from the European Common Market, one can expect a rapid rise in its future use in Pakistan. It will permit the new processing plants to operate at higher capacity and provide more milk to urban consumers. On the negative side, its ready availability in unlimited amounts at a price below the actual cost of production will keep domestic prices too low and prevent the future development of Pakistan's own dairy sector.

3. Major Impediments to Change/Progress

The current negative factors influencing milk production and marketing, as described earlier, also serve as major impediments to progress. They can be briefly summarized as follows: as long as government controls the retail price of processed milk at a level which does not cover its cost of production, collection, processing and marketing, there can be no development of the dairy sector.

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[9]A. Hafeez Khan, "Modern Milk Processing Plant Underway," The Muslim, Islamabad, December 1, 1982.

When herd owners find it impossible to cover their cost of production they will not adopt improved management practices that require an investment or higher operating expenses, even if such practices would increase their production or improve their efficiency. Thus, extension education programs will have very little success. The low retail price of processed milk will continue to be circumvented by greater sales of raw, adulterated milk. These sales, in turn, will clear the way for consumer acceptance of reconstituted milk powder imported from the European Common Market. At this point, the opportunity will have been lost for Pakistan to develop its own dairy industry.

Another serious impediment to dairy sector development is the limited representation of dairy producers at levels of government where decisions affecting their interests and livelihood are made. There is a Federal Dairy Development Board with representation from the public and private sectors where dairy development problems are discussed, but often, positive action is limited.

4. Assessment of Priorities for Change

A solution to any one of the multiple problems facing the dairy sector will not have a profound effect on moving the industry forward. There are many broken links in the dairy chain. However, there are certain major problems that have a sequential priority that must be solved or corrected before directing effort to others.

a. Increased Milk Price to Producers

The farmgate price of milk must be raised to a level that covers the average costs of production, plus an incentive margin to produce more volume. At the same time, a national policy plan must be developed on phasing down the import of milk powder in proportion to increased availability of domestically produced milk. This is to avoid unfair market competition from the highly-subsidized, low-priced EEC milk powder. Another approach would be an assessed tax on milk imports with all such revenue applied as subsidy to the farmgate milk price.

b. Improvement of Animal Nutrition

The current supply of available feed is inadequate to support the livestock population. There are two alternatives to this dilemma: (1) increase the available feed supply or (2) decrease the livestock population. The traditional concept in Pakistan is that forage production cannot compete with cash crops. Thus, it would be very difficult to increase basic forages to the level required for good nutrition of the present livestock population. A marked increase in the production and

domestic utilization of industrial by-products would make a significant contribution toward nutritional improvement. It is not, however, the complete remedy for the basic problem of livestock overpopulation.

A longer-term solution to improved animal nutrition would be the development of a national plan to reduce the livestock population. Such a policy should (1) rescind the present policy of two "meatless" days per week; (2) provide indemnity payments to farmers for compulsory reduction of animal numbers; and (3) have veterinarians designate the animals to be removed as those which have the least potential for productivity. Even though it is recognized that ownership of large numbers of animals has status appeal, it is believed that the Pakistan government has sufficient influence to carry out a livestock reduction program. This procedure is being followed in European countries and was used in the United States during the 1930's Depression.

In any event, it takes less nutrients and is less costly to produce 10 million tons of milk with five million cows and buffaloes at 2,000 kg per head, than to maintain 10 million head producing at the 1,000 kg level. The savings obtained from reduced body maintenance requirements would be 885 thousand tons of protein and 7.25 million tons of total digestible nutrients (TDN). This savings alone represents 44 percent of the present national feed protein supply and 23.3 of the total available TDN.[10]

c. Genetic Improvement of Milk Producing Animals

Even with scarce feed supplies, genetically superior animals are more productive than inferior ones. They are more efficient converters of the feed consumed. In Pakistan, there has been no scientific selection and breeding program to develop high producing dairy breeds of cattle. Relative to river buffalo in other countries, the Nili Ravi and Kundi breeds of Pakistan are respectable producers, although further genetic improvement of buffalo as well as cattle is needed.

The dramatic effect of genetics is well illustrated in Pakistan by results obtained when nondescript cows are inseminated with semen from high genetic U.S. Holstein sires. The female progeny from this cross reach maturity 10-19 months earlier and produce more than twice as much milk as their mothers. In one publication issued by the Department of Livestock and Dairy Development, Punjab,[11] it can be noted that the first generation progeny from crossbreeding (F^1) cows produced an average of 4,778 kg per lactation, compared with 941 kg produced by their nondescript mothers.

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[10]Mohammad Yaqoob Malik, *op. cit.*

[11]A Pictorial View of Livestock and Dairy Development, *op. cit.*

A national genetic improvement program designed to increase the productivity of the purebred cattle and buffalo through special selection, and improve nondescript cattle through crossbreeding to Holstein sires would contribute greatly toward higher and more efficient milk production in Pakistan. This would be a low-cost capital investment rather than an operating expense.

d. Improvement of Herd Management Through Extension Education

. If the farmgate price of milk can be increased enough to provide an incentive for farmers to increase their production sales, it will be essential for the government to provide an extension education program to help improve their herd management practices. Such education should emphasize the planning of year-round feeding programs, improved reproduction practices, raising herd replacements, selection and culling, health care and milk sanitation.

C. Project Analysis

1. Technical Aspects of Proposed Dairy Projects

The following projects are proposed in view of (i) priority problems facing the dairy sector; (ii) the type of expatriate expertise or technology that would contribute the most toward solving these problems; and (iii) the utilization of oilseed by-products by dairy animals.

Project A: Cost Analysis of Milk Production

The lack of financial incentive to dairy herd owners is the greatest, single constraint to improvement of the dairy sector. Farmers will not adopt the necessary practices to increase national milk production unless the farmgate price of milk is sufficiently increased to provide an incentive. The appropriate levels of government must be made aware of the complete nature of this problem. To bring about this awareness, accurate production cost data must be provided to them. If they respond favorably with a desire to make pricing changes, the production cost data will provide the guideline for making the needed adjustment.

The Agricultural Prices Commission (APC) was established in 1981 to provide the government with consistent and timely recommendations on input-output prices based on analyses of their effects on farm incomes and productivity. The APC was expected to have been staffed by June, 1982, and to have commenced a work program aimed at (a) designing a system for collection of on-farm data; (b) collecting data on international prices and production; and

(c) developing a methodology for measuring the effect of price recommendations on farmers' and consumers' real incomes. This work program is intended to develop the methodology of preparing timely price recommendations to appropriate government levels.

A review of several studies published since 1979,[12] shows final costs of milk production ranging from Rs 1.64 to Rs 4.78 per liter. In the Jost study, neither the value of feed produced by the farmer nor the cost of labor was included. A review of the study by Rehman and Rendall showed green fodder sales as part of milk production income. Daily consumption per animal unit was 75 kg green fodder, 1.2 kg dry fodder and 2.6 kg concentrate that would be at least 22 kg of dry matter (an impossible consumption level). Also, milk consumed by calves was listed as an expense rather than as a credit to the cows and a 35 percent culling rate distorted income figures. Saji and Jost made the error of listing both the full purchase value of the cow and its depreciation as cost items. The report by Rendall and Lockwood was the only study reviewed which appeared to use a logical economic format for analyzing income/costs of milk production, but the assumptions and nature of "purchases" and "miscellaneous" expense items were not explained.

The above summary of studies recently conducted on the income/costs of milk production does not provide the economic information needed to formulate government policies on milk pricing. Errors are indicated in these studies. Also, one-time studies are quickly outdated when price changes occur, and the economics of one sampled area are unlikely to apply to others. Therefore, it is proposed that expatriate expertise be provided to assist the newly formed APC in developing a comprehensive program on the financial anlaysis of milk production. The ultimate objective would be to provide the information necessary for the GOP to develop a milk pricing policy which will provide farmers with an incentive to produce and sell more milk.

Expatriate assistance should be directed toward developing on-farm data that accurately represent true physical and financial input-output information for each major milk producing area of Pakistan. The data system should be computerized for extensive and rapid analysis and for ease of updating when price changes occur. Data summaries should reflect variation in costs due to geographical locations and feeding systems, as well as stratification by species, herd size and yield per animal unit.

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[12]N.P. Jost, Livestock Production and Marketing Survey in the Punjab, German Agency for Technical Cooperation, Lahore, 1979; Khalil-ur-Rehman and D.F. Rendall, Cost of Producing Cross bred Herds for the Year 1980-81, Livestock Experiment Station, Qadirabad; D.F. Rendall and B.A. Lockwood, The Economics of Two Major Systems in the Punjab, Pakistan, 1981; and M.A. Saji and N.P. Jost, "Cattle and Buffalo Production and Current Constraints," Papers and Proceedings of Workshop on Economics of Village Livestock, Punjab, 1981.

The expatriate technical advisor should also provide assistance to the APC in developing methodology for testing or predicting the effect of milk price changes on both the farmers' incentive to produce and the consumers' willingness to buy. This information will be essential to making sound recommendations for changes in government pricing policies.

Finally, the expatriate technical advisor should examine the effect of imported milk products on future development of the dairy industry. Consideration may be given to import ceilings or to imposing import taxes which could be used to subsidize farm-gate milk prices.

Project 8:
Utilization of Oilseed By-Products for Milk Production

The demand for oilseed by-products for milk production will increase drastically if milk prices are adjusted high enough to give farmers an incentive to increase production. Next to poultry feeds, rations for milk production rank the highest in protein requirements. Oilseed by-products are valued primarily as protein supplements. Approximately 635,000 tons of digestible protein are required to produce 10 million tons of milk (current national production). The total digestible protein supplied by Pakistan's oilseed by-products in 1980-81 was estimated at 37,000 tons.[13] Thus, there is a great potential demand for oilseed meals and cakes in feeding dairy animals.

As oilseed production increases to meet the domestic demand for edible oils, by-products will play an increasing role in livestock rations. Therefore, it is proposed that a project be initiated to demonstrate to farmers the feeding value of these by-products for milk production.

It is proposed that the feeding demonstration be selectively located on one of the present government livestock farms or experiment stations near an oilseed extraction mill and in an area with a high concentration of dairy animals. Such a location would involve close ties with a recognized government livestock agency, the interest and support of oilseed industry representatives and an opportunity to maximize the demonstration effect to potential users (farmers) of the by-products.

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[13]Mohammad Yaqoob Malik, *op. cit.*

It is recommended that approximately 50 pregnant F^1 Holstein x nondescript crossbred heifers be secured for the dairy herd and that they be randomly assigned to three feed treatment groups as they enter first lactation. Group 1 would serve as a control group and be fed a ration typical of that fed in the surrounding area, excluding any oilseed by-product. Group 2 would receive the same basic ration as group 1, plus the addition of a predetermined quantity of the oilseed by-product. Group 3 would be fed the same ration as group 2, except for a higher level of the oilseed by-product. All cows would receive the same basic forage ration in outside feed bunks, but the concentrates and oilseed by-products would be controlled by inside feeding at milking time.

Records would be kept on feed consumption and milk production. The milk response from the additional protein and energy supplied by the by-products in rations 2 and 3 would serve as a measure for determining the nutritional value and subsequent pricing of the by-products. The feeding results would be published and disseminated to other research and extension personnel nationwide. Demonstration field days would be held to disseminate the results to milk producers in the surrounding area.

Project C: Genetic Improvement

Improved genetics increases the productivity of animals which, in turn, provides more income to herd owners. More income provides the incentive and financial ability to adopt better feeding and management practices. Thus, genetic improvement in dairy animals is the starting point for building a more efficient and productive dairy industry.

The greatest contribution that could be offered in assisting Pakistan's dairy industry is through genetic improvement. The United States has the most highly developed dairy record system for genetic improvement in the world. Through the use of this record system, the U.S. has also developed the most highly evolved and productive dairy cattle breed--the U.S. Holstein. This breed is now being used extensively throughout Europe to upgrade black and white Friesians. At the same time, the Europeans are trying to export their powdered milk and less productive Friesians to developing countries. The primary point, however, is that the background experience in developing a record system that is most effective for genetic improvement exists. The Holstein is proof of its effectiveness.

In Pakistan, the United States Department of Agriculture (USDA) set up a research design for crossing the nondesript native cows with Holstein sires by artificial insemination. Semen was provided to carry out the research. The resulting F1 female progeny was found to be more productive than the Pakistani purebreds.

These spectacular results convinced government officials to launch an extensive crossbreeding program for upgrading native cattle. The lack of a good record system to measure progeny performance will keep the breed difference concealed. In view of this situation and the importance of a sound genetic improvement program for Pakistan, the following project is proposed:

a. Provide the appropriate technical assistance and equipment to the Department of Livestock and Dairy Development, Punjab, for developing an extended permanent identification system for dairy animals and an extended production recording service. These programs will provide the tools for measuring the performance of AI progeny and for selecting genetically superior breeding stock.

b. Provide imported U.S. Holstein semen to follow-up in the initial USDA plan for upgrading nondescript native cattle. In other words, establish a leadership role in redirecting the crossbreeding program toward utilizing the superior genetics of the U.S. Holstein.

c. Provide assistance to the department for developing an effective program for maximizing the rate of genetic progress in purebred cattle and buffalo. This assistance will focus on developing higher genetic AI sires within each breed by selecting the best females in the population and mating them to the best sires. The male progeny will serve as future AI sires. The second stage, involving progeny testing young AI males before they enter active service, can proceed after the production recording service (referred to above) is well-established.

2. Social/Economic Benefits and Restraints

One-third of the population of Pakistan resides in households that own cattle or buffaloes. They provide daily care for over 10 million female cattle and buffaloes of milking age. It is unfortunate that with this large quantity of human and cattle resources, there is no incentive to produce enough milk for national self-sufficiency. This lack of incentive is financial and stems indirectly from government control over the retail milk price. The cause-effect relationship of such actions have curtailed the development of domestic resources and opened the door for European imports.

Therefore, any project that would influence government officials to correct their milk pricing policy to encourage domestic development would result in tremendous economic and social benefits to the nation. Such development would benefit the agriculture sector initially. As it became more productive and efficient, all people would benefit. The first step in this long process is

to provide government officials with the necessary economic information on milk production so they can become aware of the need to make pricing changes. The proposed project for conducting cost analyses of milk production would provide this needed information and serve as a guide for decision making on what and how much change in pricing is necessary to stimulate the dairy sector.

The projects proposed for improving the genetic level of dairy animals and for utilizing oilseed by-products will lead to higher productivity and more efficient utilization of scarce feed resources. These are the second steps to be taken to enhance development of the dairy sector.

a. The Social or Economic Benefits to be Gained by Developing the Dairy Sector

- Better utilization of existing resources which include people, dairy animals and the land devoted to forage and crop production.

- By more efficient utilization of their own resources, elimination of the need to depend on foreign imports of dairy products, thereby saving foreign exchange.

- Greater opportunities for gainful employment for rural inhabitants because dairying is the most labor-intensive enterprise in agriculture.

- Greater interest and acceptance by milk producers of extension education programs.

- Improved standard of living for the 4.8 million families who own dairy animals.

b. Social or Economic Restraints

- Reduced role of producer-retailers or middlemen selling raw milk directly to consumers. The need for this segment of the marketing chain would be partially eliminated by an increase in the farmgate price of milk.

- A short-term increase in the cost of milk to urban consumers due to the price increase to producers.

- As dairying becomes more economical, increasing competition of fodder crops with cash crops in land allocation. This may lead to less production of certain crops.

3. Environmental Effect

The projects proposed for development of the dairy sector would have no negative effect on the environment.

4. Administrative Feasibility of Proposed Projects

a. Cost Analysis of Milk Production

It is recommended that technical assistance personnel working on this project be assigned to work in close cooperation with the APC. If possible, they should be housed in the same building for maximum contact. It is essential that the APC be completely informed and supportive of the technicians' activities so the results of the project will be fully utilized by the commission in recommending changes on milk pricing policies.

b. Oilseed By-Products Utilization

This project demonstration should be administered through the Directorate of the Government Livestock Farm in the selected province. The farm should be near an oilseed processing plant that is also in an area with a high concentration of dairy animals.

c. Genetic Improvement

It is recommended that the technical assistance personnel on this project be assigned to the Department of Livestock and Dairy Development in Punjab Province. This department is responsible for artificial inseminations, animal identification and the production recording service in Punjab Province. The department headquarters is in Lahore.

Considering the objectives and activities of this project, however, it is recommended that the project be located at the AI Center in Qadirabad. This would give the advantage of centralizing a computing system to record the distribution of semen, animal identification and production records, and provide a close working relationship with the AI and Extension Service personnel. It will also be important to maintain a good communication link with the department administrators in Lahore.

D. Evaluation of Projects

Each project must have identifiable measures to monitor progress toward stated objectives. Such measures are indicated as follows.

1. Cost Analyses of Milk Production

a. Completion of data format and models of analyses that accurately measure the actual costs of milk production.

b. Development of a system for collection and cross-checking of on-farm data.

c. Approval of data format, analyses models and data collection systems by the APC.

d. Completion of a computer program with the capability of analyzing and summarizing the data, as well as the ability to predict the effect of price changes on farmer income and consumer demand.

e. Collection of on-farm data and summarization and presentation of the results to the APC.

f. Assistance to APC in formulating recommendations for government changes in milk pricing policy.

g. Survey of changes actually made in milk pricing policy at the provincial level.

h. Measurement of the effect of any price changes on producer income and attitude incentives.

2. Utilization of Oilseed By-Products

a. Completion of demonstration design including feeding plan, criteria for measuring animal performance and plans for constructing demonstration facilities.

b. Acceptance and support of demonstration plan received from directorate of government livestock farm and representatives of oilseed plant.

c. Completion of demonstration facilities and purchase of animals.

d. Summarization, publication and dissemination of results through appropriate government agncies and field day demonstration.

e. Survey to measure farmer adoption rate of feeding oilseed by-products to dairy animals.

3. Genetic Improvement

a. Approval and support of genetic improvement projects by the Department of Livestock and Dairy Development, Lahore.

b. Completion of computer program to record animal identification, distribution of semen, production of progeny and comparative analysis of sire performance.

c. Number of doses of U.S. Holstein semen utilized in crossbreeding indigenous cattle.

Number of purebred cattle and buffaloes AI progeny identified and recorded in computer system.

e. Number of production testing records in computer system.

f. Issuance of cow and buffalo performance lists to use in selecting superior females for special mating.

g. Issuance of lists for comparative ranking of sires and breeds on basis of milk yields.

E. Implementation Plan

Implementation of the proposed dairy projects has already been partially described in the foregoing sections. This section briefly outlines the cooperating agencies, geographical area covered by the project, type of input and proposed duration of each project.

1. Cost Analyses of Milk Production Project

a. Cooperating agency: The APC, Islamabad.

b. Area covered by the project: On-farm data representing milk production costs would be collected from all major milk-producing areas of Pakistan. Such areas are concentrated primarily in the Punjab and NWFP, plus the Karachi area of Sind.

c. Types of input needed:

(1) Personnel

Economist with dairy experience to serve as project leader; short-term computer programmer to develop data processing models; collectors of on-farm data; and part-time secretarial typist.

(2) Equipment

Minicomputer, transportation vehicles for data collection, typewriter, office supplies and furniture.

d. Schedule and duration of project:

(1) Year 1

Organize program, develop computer program for processing data and train data collectors.

(2) Year 2

Collect data, analyze and summarize findings.

(3) Year 3

Develop recommendations on changes needed in milk pricing policy and assist APC in consultation with provincial government agencies to promote adoption of recommended changes.

(4) Year 4

Survey farmgate milk prices and producer attitudes and phase out technical assistance.

2. Oilseed By-Product Utilization Project

a. Cooperating agencies: The directorates of livestock farms in the selected province and the Pakistan Agricultural Research Council (PARC) through its cooperative research program on oilseed crops.

b. Site of project: The demonstration feeding unit will be located on an existing government livestock farm selected for proximity to an oilseed processing plant and within a concentrated area of milk producers.

c. Types of input needed:

(1) Personnel

A dairy nutritionist with herd management experience to serve as technical advisor and project leader; a Pakistani counterpart to manage the demonstration project; and a Pakistani herd manager and working staff to provide daily care to the herd.

(2) Cows

Fifty purchased bred heifers with preference given to F^1 cross of U.S. Holstein x nondescript. If unavailable, next preference to F^2 Friesian x nondescript. (It is important to have high production potential to obtain good response from feeding trials.)

(3) Cattle housing-feeding facilities and equipment

(4) Operating budget for feed, fuel and labor.

d. Schedule and duration of project:

(1) Year 1

Construct cattle housing, feeding and milking facilities.

(2) Year 2

Obtain animals, begin feeding trials and collect data.

(3) Year 3

Conduct demonstration field days, complete the trials, summarize data and disseminate results to all appropriate agencies.

(4) Year 4

Conduct survey of oilseed by-product utilization by milk producers.

3. Genetic Improvement Project

a. Cooperating agency: The Department of Livestock and Dairy Development, Punjab, and its subdivisions of Livestock Production Extension and Artificial Insemination.

b. Central location: The primary office at the AI unit in Qadirabad, with field service activities extended primarily to the Sahiwal, Sargodha and Gujranwala Districts.

c. Types of inputs needed:

(1) Personnel

A dairy geneticist to serve as technical advisor and project leader; a Pakistani counterpart with prior educational training in genetic principles; one short-term computer programmer working with a Pakistani counterpart as a trainee; a technician to provide field guidance in animal identification and milk production recording; and a Pakistani counterpart to the field technician.

(2) Equipment

A computer and auxiliary equipment, field equipment and supplies for ear-tagging and production recording and field transportation vehicles.

(3) Imported U.S. Holstein semen

Approximately 25,000 doses annually.

d. Schedule and duration of project:

(1) Year 1

Purchase of computer and development of data analysis program; development of field recording forms for data input and purchase of Holstein semen.

(2) Year 2

Enroll herds of cattle and buffaloes on identification and milk recording service; train new field service technicians on proper procedures of measuring and recording milk production; and commence data processing of records.

(3) Year 3

Further develop computer program to provide comparative rating of sires and cow performance lists; continue expansion of herds enrolled in program, especially in private sector; and select top performance cows and female buffaloes for special genetic mating.

(4) Year 4

Continue to expand herd enrollment by issuing AI sire rating summaries and cow performance lists; publish and disseminate sire summaries and cow lists; and phase out expatriate assistance.

F. Fiscal Plan

The costs of carrying out each proposed dairy project are not based on actual cost inquiries from suppliers. They are only estimates to be used as guidelines for consideration of project proposals and include only contributions of the donor.

1. Estimated Budget to Conduct Cost Analyses Project on Milk Projection

ITEMS	Donor ($)
1. Dairy Economist at $180,000/yr x 4 years	720,000
2. Computer programmer for 6 months	100,000
3. Part-time typist/secretary	20,000
4. Minicomputer	20,000
5. Typewriter, office supplies and furniture	10,000
6. Three transportation vehicles at $10,000 each	30,000
7. Fuel and maintenance of vehicles for 4 years	40,000
TOTAL estimate	740,000

2. Estimated Budget to Conduct Oilseed By-Product Utilization Project

ITEMS	Donor ($)
1. Dairy Nutritionist-Project Advisor $180,000 x 4 years	720,000
2. Purchase 50 bred heifers at Rs 8,000 each ($632)	32,000
3. Construction of housing, feeding and milking structures	30,000
4. Machinery and equipment: 1 tractor ($15,000); porage wagon ($5,000); manure spreader ($5,000); milking equipment ($7,000)	32,000
5. Miscellaneous tools and dairy supplies	5,000
TOTAL estimate	819,000

Note: It is assumed that milk sales will cover operating costs of feed, labor, fuel and veterinary medicine.

3. Estimated Budget for Genetic Improvement Project

ITEMS	Donor ($)
1. Dairy geneticist at $180,000/yr x 4 years	720,000
2. Computer programmer for 6 months of year 1 and for 6 months of year 2	200,000
3. Part-time typist/secretary at $400/month for year 4	5,000
4. Computer and auxiliary equipment and supplies	80,000
5. Imported U.S. Holstein semen. 25,000 doses/yr at $6.00/dose x 4 years	600,000
6. Field equipment and supplies for animal identification and production testing	20,000
7. Two vehicles for project leader and field technician at $10,000 each	20,000
8. Vehicle fuel and maintenance for 2 vehicles x 4 years	27,000
TOTAL estimate	1,672,000

6. Policy Commentary

1. Project on Cost Analyses of Milk Production

a. Government of Pakistan Perspective

(1) No current issues recognized.

(2) Potential future issues. If the APC recommends changes in government milk pricing policy to improve producer income, the net effect of price changes would increase the retail milk price to consumers or reduce the profit margin of processing plants. The GOP should expect opposition from these groups.

b. Donor Country Perspective

(1) Current issues. None, because firms representing EEC interests are planning a network of modern plants to process imported milk powder for the urban market.

(2) Potential future issues. If the GOP takes steps to develop its domestic production of milk and to impose ceilings or taxes on powder imports, its policy would conflict with EEC marketing goals. EEC can be expected to register opposition to top GOP levels.

2. Project on Utilization of Oilseed By-Products

This project is not expected to raise any conflicting issues with any government.

3. Project on Genetic Improvement

a. Government of Pakistan Issues: none.

b. Donor Country Potential Issues

Friesian heifers, bulls and semen are now being exported from Europe to Pakistan. It is interesting to note that EEC countries are importing Holstein semen from North America to upgrade their own Friesians. This project can expect to meet opposition from European technical advisors as it develops a program to measure genetic differences in AI progeny and reintroduces Holstein semen into Pakistan.

MEAT AND MILK PRODUCTION AND MARKETING

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A. Summary and Recommendations

1. Summary

This presentation includes a brief review of the livestock and milk production and marketing systems in Pakistan, together with related comments and recommendations. The results of this study indicate that on the meat production side, fairly reasonable returns are received by farmers for the sale of sheep and goats for slaughter. On the other hand, retail prices of beef are too low for farmers to realize a profitable return from production of beef and buffalo for meat. Therefore, sales of slaughter cattle are limited largely to old milk cows and buffalo, their unwanted male calves and discarded draft animals.

There have been improvements in the milk marketing infrastructure, but the available supply is small and seasonally erratic. Efforts by government and others to correct the deficiencies continue. Profitability of milk production is low, but considerably more favorable than that of production and sale of cattle or buffalo for meat.

Livestock feed supplies are limited and under increased pressure from the large number of unproductive livestock. Consequently, the nutrition level of all animals leaves much to be desired.

2. Recommendations

- Raise retail prices on meat and milk to a level that will cover production, processing and marketing costs and provide a margin of profit to producers.

- Conduct, on a continuing basis, extensive analysis of production costs of all livestock and livestock products, particularly meat and milk, to provide a factual base for recommended price changes in meat and milk.

- Conduct a detailed study to determine the feasibility of loan support for the private sector to establish an integrated system involving production, processing and distribution of meat and its by-products.

- Conduct a detailed study to determine the feasibility of loan support for private enterprise to establish an integrated system involving production, processing and distribution of milk and its by-products.

- Provide technical expertise for research and training to the provinces of Punjab, Sind and NWFP for research and training in agricultural economics, agronomy, breeding and genetics, feeding and nutrition, farm management and agricultural communications.

- Increase feed resources by increasing forage yields per unit of land by improving the use of crop residues, agro-industrial by-products and wastes.

- Extend and strengthen the agricultural planning effort at both the national and provincial levels by providing technical assistance and training in agricultural economics.

B. Brief Description of the Study

In preparing this report, extensive use was made of the latest publications by the Government of Pakistan and other donor institutions on livestock production, processing and marketing in Pakistan. In addition, there were field trips to study the four provinces. These visits permitted observations and discussion with GOP and provincial livestock leaders.

1. Production

The first limiting technical factor on production is inadequate nutrition. Feed resources are in short supply and are used inefficiently, largely because of inadequate knowledge of the essentials of ration balancing. Also, the problem is aggravated by the large supply of unproductive animals. If prices of animal products were favorable, farmers would be motivated to produce higher quality forages and to make better use of crop residues, mill feeds and industrial by-products.

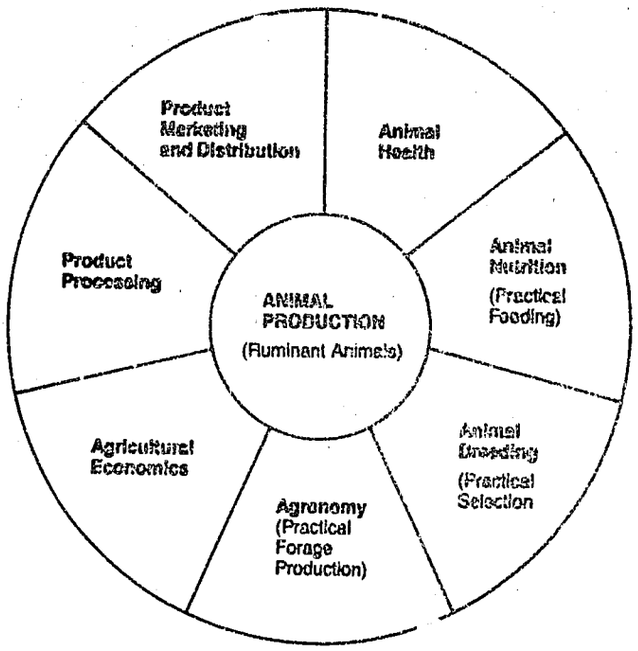
If feeding were optimized, the genetic potential would soon become the factor limiting production. This potential can be improved by putting selection pressures on present animals and by crossbreeding. Both require more time to become effective than do environmental changes such as feeding. Nevertheless, Pakistani authorities must initiate programs for genetic improvement of buffaloes and cattle.

Accurate data on farmer production costs as well as those associated with processing and marketing are limited. Reliable information on production costs would be particularly helpful to the Agricultural Prices Commission (APC) in working out realistic retail prices.

There is little evidence that the various disciplines commonly used in animal production are being integrated into successful animal production programs in Pakistan. In fact, there is clearly an overemphasis on the veterinary medicine-related disciplines at the expense of economics, agronomy, breeding and practical feeding. What is needed is an integration of all disciplines in a production program as shown in Figure 1.

Figure 1

Integration of Disciplines for Animal Production



- Animal production is placed in the center of the "pie" and the person in that position should be a generalist with strong emphasis in animal production and economics. Alternatively, he could be an economist with general knowledge of animal production.

- Animal health concerns disease prevention rather than treatment. The animal health expert should be a veterinarian with solid experience in reproductive physiology and artificial insemination (AI).

- Animal nutrition concerns the development of economical feeding programs.

- Animal breeding concerns practical selection and crossbreeding programs. Genetic improvement of animals for production is this profesional's goal.

- Agronomy concerns, in the main, forage production for animal feeding. Emphasis must be on increasing yields as well as quality. Working with the nutritionist, the agronomist can produce forages that are best for various productive purposes and determine the place of livestock in the cropping systems.

- Agricultural economics concerns work with all the disciplines involved in production, processing and marketing. Cost-effectiveness is the most important goal, and the economist must provide the necessary input to promote this.

The buffalo is likely to continue to be the animal of choice for milk production for many reasons. The main one concerns the fact that it is here, attesting to its adaptation to the different environments of Pakistan. Although the average production of the buffalo cow is only about 1,800-2,000 liters in a 305-day lactation period, it is much higher than that of the nondescript cow. Also, buffalo milk is much richer in both fat and solids-not-fat (SNF) content. If the consumer in Pakistan continues to accept milk with a 3.5 percent fat test, the average yield of the buffalo would be doubled to 3,600-4,000 liters. The fat test of buffalo milk is about 7 percent.

Furthermore, it appears that the genetic potential for milk production in the buffalo is much higher. One cow at the Bahadarnagar Research Center in Punjab produced a record yield of 5,600 liters. There were others in an elite group that were producing more than 4,000 liters per lactation, testing 6.8 percent fat. This would be equivalent to 10,880 liters (23,936 lbs) per lactation of 3.5 percent fat milk--quite a respectable average. Also on the same station, there was a first progeny generation from crossbreeding (F^1) offspring resulting from a Holstein-Friesian bull and nondescript cow that produced 8,600 liters of milk, testing 4.2 percent fat. This would be equivalent to 10,320 (22,700 lbs) of 3.5 percent fat-test milk per lactation.

There are about 40,000 second and third lacation buffalo cows in the Landhi Milk Colony near Karachi. These Nili/Ravi cows are purchased shortly after parturition in Punjab Province and are subsequently, without calves, transported to Karachi on an intensive milk-producing scheme. After the lactation cycle is finished, the cows, still unbred, are sent to the abattoir--a serious waste of milk and meat potential. If the cows were rebred and kept in the Karachi area, there would be at least 12,000 bull calves (assuming a 60 percent calving rate) available for fattening to a weight of about 400 kg. This would, if prices were sufficient to cover feeding costs and provide a profit margin, supply an additional 240 metric tons of beef to Karachi markets. Technical assistance for this project in Sind Province is indicated.

Cattle, in contrast to buffalo, are kept by the small farmer primarily for draft purposes. For this reason, male calves are in demand. The demand for male buffalo calves is almost nil, so they are slaughtered while quite young for veal production. Preliminary data indicate that the young buffalo male, if fed whole milk, high-quality forage and high-energy feeds could weigh about 400 kg when 12-15 months old. Instead, it is slaughtered

when weighing only 82 kg. If it were fed, the meat output from this animal alone would be about 240,000 metric tons instead of the present 44,000, a gain of almost 200,000 metric tons, or nearly 30 percent over the 1981 FAO estimated production of beef, veal and buffalo meat in Pakistan.

Nondescript cows that are used to produce bullocks for draft purposes are poor milk producers, resulting in an excess of low-producing cows in the country. Research results at the Bahadarnagar Station indicate that the F^1 progeny of Holstein-Friesian or Jersey bulls x nondescript and Sahiwal or Red Sindhi cows are good milk producers. The males are suitable in the Punjab for draft purposes. As a result, the cattle crossbreeding program at this time is attractive to Pakistani livestock industry leaders, primarily because the use of AI could change the cattle population quite rapidly.

However, keep in mind that the present number of crossbred cattle is limited. The results of comparative studies already conducted are questionable when overall problems are considered. For this reason, research studies should be extended to cover a wide range of conditions, preferably in each of the four provinces. The studies must include relative performance of these animals for milk and work production under different environmental and feeding conditions. Even though the possibilities of the cattle crossbreeding program appear promising, it would be prudent to be certain it is thoroughly understood before rushing into a rapid development program designed to promote crossbreeding.

A cursory examination of overall feeding and management of experimental animals at Bahadarnagar indicated they were satisfactory. However, there are weaknesses in production economics, animal nutrition, forage production, animal breeding, reproductive physiology, product technology and the organization of those disciplines into a total production program. These disciplines should be strengthened by the provision of additional technical experts.

As Punjab Province and the Bahadarnagar Station are beginning to emphasize livestock extension, the provision of an expert in the field of communications to work at the station and at the provincial headquarters would be timely and helpful. This is especially true since the research station is associated with many tenant farmers who each use 12.5 acres of land under an intensive farming program. These farmers could quickly apply techiques found in research if they were practical and understandable.

2. Marketing

Deficiencies in the marketing system often are cited as the major constraint on livestock and dairy production in Pakistan. While marketing costs are high and returns to producers relatively low, the system appears to function reasonably well; any attempt to alter it by direct intervention or regulations would be unwise. In addition to providing the basic service of moving livestock and their products from the farm to consumers, the system serves the farmer in other important ways. For example, farm products that lend themselves to forward purchasing, such as milk and wool, provide a basis for farmer credit. The buyers lend or pay in advance for such products on the understanding that the farmers will sell to the lender only. This is often of considerable importance to farmers who have few options in obtaining ready cash or operating capital. Of course, the buyer (middleman) is in a position to take advantage of the situation by paying low prices for products against which he had given advance payment.

Middlemen take advantage of the farmer in other ways. For example, the farmer selling cattle for slaughter often must wait several days for payment. This deferred payment continues through the marketing process until the meat reaches the consumer who pays cash. After the sale to the consumer by the butcher, payments are made back through the system and finally to the farmer who has, in effect, financed all the transactions. The practice is unfair, but the farmer is in no position to protest.

A 1980 study in Sind Province showed that the farmer received an average of 37 percent of the consumer's rupee spent for meat (Table 1). The study indicated that the farmer's share ranged from 31 percent for cattle sold for slaughter to 43 percent for goats. There are often as many as five middlemen claiming the 57 to 69 percent balance.

Table 1

Breakdown of Consumer's Rupee Spent for Livestock

Agency	Cattle	Buffalo	Sheep	Goat	Average
Producer	31	36	38	43	37
Wholesaler	42	35	27	23	32
Commission Agent	23	25	32	30	27
Retailer	4	5	3	4	4
TOTAL	100	100	100	100	100

It is interesting to note that according to the Sind study, the farmer receives a smaller share of consumer expenditures from sales of lower priced beef and buffalo meat than from the substantially higher-priced mutton and goat (Table 2). There is a relatively higher return for goat meat, apparently because it is the preferred meat in Sind Province and the competition among buyers, as well as the higher control price helps boost the farmers' share.

Table 2

Animal Product Prices

Item	-----Rs.----- Price Range	Unit
Chicken (broiler)	26/28	kg
Chicken (desi)	32/34	kg
Mutton (including goat)	24/26	kg
Beef	10/12	kg
Eggs	9/9.50	Dozen
Milk	3.50/4	Liter

The larger returns to farmers from higher-valued animals suggest that higher prices paid at the retail level for meat tend to be reflected in the form of a larger relative share of consumer expenditure for meat. This strengthens the argument that increases in the controlled retail price of beef would, likewise raise the farm price. However, it is not really clear whether it is the higher retail price, the stronger demand for goat or a combination of the two that results in a larger share of consumer expenditures for goat meat reaching the farmer. Therefore, a closer examination of all factors involved should be carried out to clarify the situation.

An increase in the retail price of beef would encourage farmers to feed their younger animals for beef production, increasing the quantity and quality of beef. If higher quality beef were available, demand would strengthen and stimulate competition between middlemen buyers and traders. This situation would tend to make prices rise and increase the farmer's share of the consumer's rupee spent for beef.

Furthermore, the introduction of a simple meat grading system to identify quality variations in beef and buffalo meat would be helpful. Members of the middle and upper economic classes, as in many countries, would select and pay higher prices for higher quality meats if they could be identified through the marketing

system. This would increase demand for these cuts, while increasing the supply of the low-priced cuts which could be purchased by people in less advantageous economic circumstances.

The slaughtering and processing facilities in Pakistan are unsanitary, inefficient and extremely wasteful of animal by-products. There have been attempts in the past to improve this condition by the construction of modern abattoirs at Karachi and Islamabad. However, neither are in full operation at this time. A third plant was to be built in Hyderabad, but the equipment has been lying packed in crates for the past several years.

The Karachi plant was built in 1972, with financing and equipment from the Government of Yugoslavia, and began operation under the direction of the Karachi Municipal Corporation. The plant was designed for a killing capacity of 400 cattle and 4,000 small stock per eight-hour shift. Initially, the plant operated with fair success. Suspicion by the butchers and consumers that cattle and sheep were not slaughtered in the Muslim way, however, and the plant's distance from the central city precipitated the decline of the operation. The uncertain supply of livestock also led to problems of operating efficiency. Perhaps one of the greatest difficulties was associated with the fact that the plant was managed by a government agency unequipped to handle a large commercial operation successfully. Private ownership might have offered a much stronger and more successful effort to correct deficiencies.

The abattoir in Islamabad was also financed by the Government of Yugoslavia in 1970, and operated until 1979 as a source of meat for local shops. In 1980, municipal authorities changed the function of the plant to a custom slaughtering operation because it was failing financially for reasons similar to those resulting in the demise of the Karachi abattoir. The facility is now substantially under-utilized. It was designed for a slaughtering capacity of 100 cattle and 1,000 small stock per day. Presently, 50 to 60 cattle are being slaughtered each day, but no small stock.

In Hyderabad, all the plant equipment has been in storage since the early 1970's, packed in the original shipping crates. Although the Baluchistan authorities were at one time interested in obtaining this equipment for installation in Quetta, it could probably be put to better use if the private sector would become interested. Before further efforts to establish modern meat processing facilities in Pakistan are attempted, a thorough study of the requirements for success should be made.

The government has given many so-called incentives to livestock owners for increasing meat and milk production. Such incentives include no income tax, unlimited holdings of land, duty free imports of breeding animals and various subsidies dealing with AI and disease control. The government has, at the same time, inconsistently imposed restrictions on meat consumption and demand for meat by the Slaughter House Act's meatless days. In

reality, this regulation probably has little effect on red meat consumption because, in many instances, meat is purchased ahead and consumed on those "meatless days."

Livestock producers have been denied the one incentive that allows crop farmers to enjoy a reasonable level of prosperity--namely, a fair price for their product. While the government stands ready to buy major crops at favorable prices, meat animals are traded in the private sector where marketing costs reduce further the farmer's share of the government-controlled price on which market prices for animals are based. The only incentive that could conceivably encourage increased meat output, particularly of beef, is the permit to export 50 percent of the animals produced in commercial feedlots. However, improved slaughtering and processing facilities will be required before such exports are possible in significant quantities. If the government is serious about increasing meat production, particularly beef, the price incentive must be provided. Without it there is unlikely to be any change in farmers' attitude toward increasing production of this product.

In a country with a rapidly growing population, it is unfortunate that such a large potential source of badly needed protein is neglected. By at least raising beef prices to the level of mutton prices, sufficient incentive would likely be provided to bring about a significant production response from farmers.

Milk production in Pakistan is relatively large due to the large numbers of milk cows and milking buffaloes. However, an inefficient distribution system into urban centers has prevented full utilization of fresh milk supplies. It has also prevented many farmers from receiving fair income from milk produced. The development of a coordinated milk marketing system has been restricted by small herd size, seasonal as well as low production and wide distribution of animals.

To meet the demand for raw milk in urban areas, many cows, particularly buffaloes, are kept within the cities. This producer-to-consumer raw milk market presents problems relating to poor sanitation, adulterated milk and inadequate, high-cost feed resources. A more workable alternative would be to keep the animals in rural areas and develop a system in which milk would be moved and distributed in an orderly way to urban consumers.

Such a system of marketing is being developed in Pakistan, but it is severely constrained by the government's imposition of retail price controls on processed milk. Unfortunately, the controlled retail price does not cover costs of production, collection, processing and distribution, plus a reasonable return to producers and processors. Consequently, production is low and seasonal, and milk processing plants cannot obtain the volume necessary to operate efficiently. If the situation does not improve, many processing plants now in operation will probably be forced to close. In fact, without the supply of readily available imported milk powders that are reconstituted, many process-

ing plants could not continue to operate. A continual supply of milk is the key to their survival.

A properly coordinated milk production-processing-distribution system is needed. This should be done by the private sector, and with the availability of GOP lands in large tracts for livestock production, it would likely be possible. Therefore, it is proposed that donor funds finance a detailed feasibility study involving entrepreneurs from Pakistan and abroad. This could lead to joint ventures in establishing integrated milk systems near large cities. The production aspect of the project would supply enough milk to permit the processing plant to break even; after this, it would utilize the milk from the collection schemes to operate at capacity.

3. Research and Training

The following observations and comments reflect some of the research and training requirements of those involved in the production, processing and marketing of livestock and livestock products in Pakistan.

- Research is underway in various areas of animal production. However, the economic inputs associated with many research projects are limited, and this deficiency restricts the practical value of the results.

- As many livestock leaders in Pakistan are veterinarians or were trained in faculties of animal husbandry and veterinary science, their training in other disciplines is sometimes limited. For a livestock production program to be successful, it must fit into a farming system and not the reverse. Therefore, lack of training in agronomy, soils, animal breeding, nutrition and agricultural economics severely limits the successful integration of the various disciplines into a well-rounded research program.

- The officers and technical staff at various research institutions visited agreed that the technical expertise needed to be broadened and upgraded. These needs have been addressed in the project proposal section of this paper.

4. Agricultural Planning

Planning is an essential element of a controlled and rapidly advancing development program. The Government of Pakistan believes strongly in the necessity for planning the economic and social development of the nation and has responded to this need by providing a planning structure. Major responsibilities for the preparation and review of national plans rests with the Planning Commission, a unit that sets national targets

and determines the strategies for achieving these goals.

Essential for the effectiveness of the Commission's efforts are the inputs provided by the various federal ministries and provincial planning units. From both levels there is a steady flow of information in the form of raw data, briefs, outlines of plans or projects and fully developed proposals. With this broad spectrum of resources available, the Commission is able to draw up national development plans crucial to the continuing advancement of the economic and social well-being of the Pakistani people. The provincial governments have similar structures for planning the development process. Here, the ideas and proposals originate at municipal levels or from branches of provincial government agencies such as research stations and veterinary institutes.

However, while the basic organizational planning structure is in place, economic and social considerations often have been relegated to a secondary position and appear to have been essentially ignored on the livestock side. It is easily recognized that the livestock subsector has received low priority in agricultural planning. Considering the substantial potential of this subsector in Pakistan, the seeming lack of interest in animal agriculture is unusual, particularly considering that other areas of agricultural production have been provided substantial government support and encouragement.

Red meats and milk are valuable nutritional products. If their development is encouraged, they could contribute significantly to the economic well-being of farmers, as well as to the health of the country. It has been pointed out in other sections of this paper the significant expansion possible in livestock production if farmers are given the incentive. Basically, the ingredients essential to the encouragement of beef and dairy production are economic. If farmers can raise their incomes, their quality of life will generally improve.

D. Proposed Projects

1. Meat Feasibility Study

The basic objective of the study is to determine the feasibility of establishing modern slaughtering, processing and marketing facilities in Pakistan for cattle and small stock. The study would involve three general areas: supply, processing and marketing. The major issue involves establishing the fact that meat processed under modern plant conditions would be acceptable to the people of Pakistan, particularly in view of the initial problems associated with the failure of the Karachi and Islamabad plants. If acceptability problems were overcome, the study group would consider the best location for such a plant or plants, with the possibility of utilizing the existing Karachi and Islamabad facilities and the crated equipment lying unused in Hyderabad.

To move large quantities of meat from one source or outlet, a distribution system involving refrigerated transport and refrigerated storage facilities at strategic locations would be needed. Also, the export market for beef and lamb would be explored in detail as well as markets for animal by-products. For large meat processing and distributing operations to run efficiently, they must have available a constant and reliable source of slaughter livestock. This aspect needs to be examined throughly and will involve the consideration of feedlots and their location for cattle, buffalo and small stock.

The location of the livestock supply may well affect the location of abattoirs. It has been the tendency in developed countries to establish slaughtering and processing plants near producing areas. Until the Pakistanis come to accept the fact that chilled meat from large abattoirs was killed and processed according to Islamic tradition, these plants probably should remain near population centers.

It is strongly recommended that this proposal be handled by a joint venture in the private sector between expatriate and Pakistani business enterprises. Two such firms would provide the personnel and other inputs necessary to conduct a detailed feasibility study paid for by donor funds. Then, if prospects for success appear reasonably positive, a joint venture with donor loan support through the Overseas Private Investment Corporation (OPIC) would be in order.

It is estimated that the cost of a complete feasibility study might reach $500,000. It is not possible to estimate expenditures beyond that point because there are too many variables to permit a realistic assessment.

2. Technical Assistance: Punjab Province

a. Objective

The objective of this project is to provide high-level technical assistance not currently available to the Bahadarnagar Research Station. The team of experts would assist the station and Punjab Province institutions generally, to expand and upgrade their research programs to facilitate accelerated development of the livestock and dairy subsectors in the Province. Also, much of their findings in the Punjab could be extended to other regions of Pakistan.

b. Technicians

There would be six postgraduate level technicians as follows:

(1) Livestock Economist. This technician would collect cost and returns data and study the production systems on sample farms drawn from the 100 plus tenant farms associated with the experiment station. He would involve himself with the economic components of the station's research projects, as appropriate, and work on improving the marketing system to give the farmer a larger share of the consumer's rupee.

(2) Animal Breeding Expert. The animal breeding expert would concern himself with practical selection and crossbreeding for genetic improvement to increase the productivity of animals--his major goal. He would join forces with the economist and the feeding specialist to encourage tenant farmers to cull unproductive animals from their herds. Also, with the assistance of his colleagues, he will develop a set of meat grading standards for cattle, buffalo and small stock, based on a simple relationship between age and finish of the animal. In addition, he will join local veterinarians in developing an animal health program to complement the current animal disease control program.

(3) Feeding Specialist (Nutrition). The development of least-cost rations would be given major emphasis, together with the development of feed standards. The rations must utilize to the maximum, feedstuffs readily available to farmers in a given area. The feeding specialist would also test low-cost milk replacers for raising buffalo calves, along with the practicality of feeding buffalo calves from birth to a market weight of 400 kg. He would conduct experiments to obtain data on the relative values of high-protein feeds such as cottonseed and soybean meal, versus cottonseed cake, in rations of milking buffaloes, obtaining measures on economic milk yields and composition of milk.

(4) Agronomist. Initial responsibility would be to increase forage production through the testing of new varieties, emphasizing yields and quality. The agronomist would work closely with the nutrition specialist to assure the growing of forages best suited to high production and quality. Work with other crops on the station and tenant farms would also be included.

(5) Information Specialist. This expert would evaluate various methods of disseminating production and marketing research information to Pakistani farmers. Such information would not be limited to reporting

experimental results from the station's research program, but would include general information on animal production, breeding, feeding and farm management. He would also involve himself in producing various extension materials such as slide shows, films and seminars.

(6) Farm Manager. This specialist would oversee the management of experimental farms in the Province. Farm manager trainees would be largely Faisalabad University graduates in agriculture. They must be given full authority over the management of these farms without interference from provincial or federal officials. The position requires a person with a postgraduate degree and a thorough understanding and appreciation of research as related to farming. He must have practical experience in management and agricultural enterprise.

All experts would work as a team on projects complementing their respective disciplines and be expected to extend their expertise beyond the research station, as time permits. Such activity would include lecturing at the Agricultural University at Faisalabad and Lahore, as well as at the Punjab Livestock Training Center at Sheikhupura. They would also be expected to respond to requests from other experimental stations for assistance in developing or evaluating research projects. In short, they would make themsleves as useful as possible at all levels. The experts would fill established posts and fit into the organizational structure of the experiment station.

c. Training

This component would involve the training of replacements for the six specialists. It would be preferable if two trainees or counterparts could be provided for each of the six positions. One counterpart would work with the specialist while the other was abroad on his training program. Upon the latter's return to Pakistan, the former would leave for training. The man trained first would then work with the expatriate specialist for one to two years.

d. Housing

All six experts and their families would live on the research station, and the provincial government would provide each a house, furnishings and utilities.

e. Materials and Equipment

Item	$U.S. Cost
Minicomputer	$20,000
Program calculators	1,000
Office equipment and supplies	10,000
Extension equipment and supplies	10,000
Vehicles (3)	45,000
Fuel and maintenance	25,000
TOTAL	$111,000

f. Total Costs

Item	$U.S. Cost
Six specialists for 5 years	$4,500,000
Training (12 students for 2 years)	600,000
Material and equipment	10,000
TOTAL	$5,210,000

3. Technical Assistance: Sind Province, Red Sindhi Research Station, Buffalo Research Station

a. Objectives

The objectives of this project are basically the same as those of the technical assistance program at the Bahadarnagar Research Station in Punjab Province. A team of four experts (a livestock economist, an agronomist, a feeding specialist and a breeding expert) would work mainly at the two research stations mentioned above and extend their efforts around Sind Province in much the same manner as the Punjab research team. All experts would fill established posts and fit into the organizational structure of the experiment station.

Special efforts would be made by the animal breeding expert to set up a breeding program for the buffalo on the Landhi Milk Colony near Karachi. This would involve the establishment of AI centers in the area.

The feeding specialist and the agronomist would work with the breeding expert in developing a system of production to provide the additional feed necessary to carry the Landhi buffalo through the five to six month dry period.

The livestock economist would also involve himself in working out costs and returns to the buffalo owners in the Karachi buffalo colony. In addition, extra duties will include work on a distribution system or some other scheme to bring about a balance between the surplus milk-producing areas of Northern Sind and the milk-deficit area of the South. The team will develop the two research stations, but the methods used will be up to them and the provincial officials. Hopefully, they would look at the possibility of testing other breeds on the Red Sindhi Station as this breed seems to have relatively low productivity potential.

b. Training

The training component would be handled in the same way as in the Punjab project.

c. Housing

The four specialists and their families would live on the Red Sindhi Station, and the provincial government would provide each a house, furnishings and utilities.

d. Materials and Equipment

Item	$U.S. Cost
Minicomputer	$20,000
Program calculators	1,000
Vehicles	30,000
Office equipment and supplies	8,000
Fuel and maintenance of vehicles	20,000
TOTAL	$79,000

e. Total Costs

Item	$U.S. Cost
Four experts (5 years)	$3,000,000
Training (8 trainees)	400,000
Material and equipment	79,000
TOTAL	$3,479,000

4. Milk Feasibility Study

The basic objective of the study is to determine if it is feasible to establish an integrated milk production, processing and marketing system for cattle and buffalo milk. The major issue involves the fact that many of the milk processing plants now in operation are under severe financial problems unless they have facilities to reconstitute imported milk powders. The reasons concern the low and variable supply of milk by small producers for processing. For example, 11,000 liters of milk were collected daily from 132 dairy cooperatives in the districts of Sahiwal and Sargodha. As this amounts to only 83 liters per cooperative, it is apparent that supply is a major problem for processors. For survival, a milk processing plant must have a continuous source of milk. If that requirement were met, the processing plant could develop its distribution and marketing system in urban centers.

Recent changes in land tenure laws now permit individual or corporate ownership of large tracts of land for the production of livestock or livestock products. These changes make it possible for the private sector to own production units that would provide a constant supply of milk to their processing and distributing systems. If such units were of sufficient size, they could produce enough milk to permit efficient functioning of the processing and marketing phases during periods of reduced supply from the cooperatives.

It is strongly recommended that this proposed study be made by the private sector. It should be a joint venture by expatriate and Pakistani business enterprises. These firms would provide the personnel and other inputs necessary to complete a detailed feasibility study paid for by donor funds. If prospects for success were favorable, it is hoped that a joint venture with donor loan support through the Overseas Private Investment Corporation (OPIC) could be made for establishing a well-coordinated system.

Costs would be less than the meat study, or about $200,000.

5. Training Institute

a. Project

The Directorate of the Veterinary Research Institute in Peshawar proposed that donor funding finance the establishment of a School of Animal Health and Production in NWFP, Peshawar. Their project paper suggests that there is an acute shortage of properly trained paraveterinary staff in NWFP and no school in the Province offering training of the type required. The proposal involves utilization of existing staff facilities of the Animal Husbandry Department and Veterinary Research Institute to establish a school in the NWFP for providing courses of varying nature, duration and level of training.

The program would include two years' in-service training for diploma level in veterinary science and animal production, as well as lower-level training for laboratory assistants and attendants. Short courses in poultry, dairy, animal husbandry, sheep farming and artificial insemination for both the private and public sectors would also be offered. Subject matter in the divisions of microbiology, biological products, parasitology, animal production and poultry would be taught by staff members of the Veterinary Research Institute and various disciplines of the extension wing of the Animal Husbandry Department. Subject matter of the program seems to be largely geared to veterinary disciplines, with some animal production courses.

The school would train up to 20 students per year in two-year diploma courses for in-service veterinary compounders. In addition, short courses would be provided for 40 trainees in lower-level jobs and for 40 poultry farmers and other members of the public.

Costs of the scheme are estimated to total about $350,000. A rough breakdown of this amount would be as follows:

Item	$U.S. Cost
Pay officers (3 years)	$ 8,000
Pay of establishment (3 years)	15,000
Overhead, allowances, housing	56,000
Travel allowance	2,000
Foreign exchange component*	234,000
Contingencies	35,000
TOTAL	$350,000

*Includes purchase of bus, equipment, books and journals and the services of one foreign expert.

b. Comment

Although there is evidence of considerable foresight in the project paper, there are some negative aspects to the proposal. The basic negative feature is the limited area of instruction offered. Most courses relate to veterinary medicine with a smattering of animal production. It is recommended that the training program be broadened to include agronomy and agricultural economics, and an expatriate staff brought in to strengthen these subject areas. If the existing staff is found to be untrained or undertrained in other disciplines, expatriate staff should make up such deficiencies until people can be trained to replace them. In short, a review of the proposal suggested that a large training component is required and more expatriate staff needed to fill disciplines that are absent or not fully provided.

6. Planning Project

The objective of the agricultural planning project is to aid the Government of Pakistan in efforts to improve its rural development planning capabilities. Emphasis is to be placed on economic input to the livestock subsector. The project will concentrate on two areas:

(1) To accelerate localization by providing practical in-country training and overseas coursework.

(2) To provide the Ministry of Agriculture Technical Unit (Planning), as well as provincial planning units, with expatriate planning experts who will assist in development planning and project preparation while Pakistanis are being trained. The project will expand the planning capability of the Ministry of Agriculture Technical Unit (Planning) and provincial level agricultural planning units by the provision of two economists at the federal level and in each of the four provinces. These economists would be planning specialists--one in general crops agriculture and the other in livestock. The presence of these planners would strengthen all planning agencies' agricultural input and, more specifically, emphasize the importance of developing the livestock subsector.

An additional expatriate staff member will serve as a temporary agricultural economist/trainee. His terms of reference would include teaching refresher courses in mathematics, statistics and economics to strengthen the background of students before leaving for overseas training, involving potential students in all disciplines. He would also supervise thesis research for the agricultural economics students and ensure adequate economics analyses in the thesis design of other disciplines. His function would be phased out at the end of the project.

The training component would include two counterparts for each expatriate position, or 20 Pakistanis--four at the Federal Ministry of Food and Agriculture and 16 at the provincial level.

Costs for the agricultural planning project are as follows:

Item	$U.S. Cost
Expatriates (11: 10 agricultural economists and 1 agricultural economist/trainer)	$6,600,000
Training (20)	1,000,000
Vehicles (5)	75,000
Maintenance and fuel	35,000
TOTAL	$7,700,000

7. Stud Flocks (Small Ruminants)

The objective of this project would be to improve the genetic potential of sheep and goats throughout Pakistan by providing high-quality breeding stock to farmers through a government-subsidized program. Selection of breeds of sheep and goats to be included in the program would depend on the region, taking into account breeds now being produced, type and quality of feed available and whether emphasis is on milk, wool, meat or some combination of the three.

Particular care should be taken in recommending crossbreeding, as opposed to upgrading by selection and use of high-quality rams. Often, the indigenous animal is well-adapted to a given region or management system and interference in its genetic makeup may change its nutrition requirements, heat tolerance or other positive features, negatively affecting adaptability and productivity.

Established experiment stations in the four provinces might be desirable locations to begin this program as there are currently similar projects underway at some stations. The research staff associated with some of these experimental stations, particularly the animal breeding specialists, could provide useful input into selection and crossbreeding programs.

A closer examination would need to be made of the requirements for additional technical staff for these breeding programs. Perhaps the addition of a sheep and goat specialist at some stations would be desirable. In such cases, a component should be included for funding the expatriate specialists as well as counterpart training.

Costs are difficult to estimate in this case, as they would depend on how extensive such a program would become.

E. Social and Economic Benefits

Economic and social benefits are clearly evident in all the foregoing projects. Of course, some proposals more directly affect farm income and subsequent social advancement than others. For example, an increase in beef prices would quickly affect a rise in farm prices for cattle, and in the longer term boost the demand for beef. On the other hand, the benefits realized from programs involving technical assistance and training in research and planning would mean a somewhat longer interval between implementation and benefits. The same is true of the introduction of stud flocks and artificial insemination schemes.

Nevertheless, all program objectives point to the improvement of farm income through increasing productivity, improving the quality of feedstuffs and animal products and promoting efficiency in the marketing system. It is believed that these

efforts, collectively, will affect across-the-board benefits in terms of improving the economic and social well-being of the farming community, and particularly effect positive changes in the livestock sector.

The program will involve agronomic studies to increase forage supply by increasing yields per unit of area and improving the utilization of crop residues and agro-industrial by-products by research and demonstrations in animal nutrition. Good cost analysis data on these projects would enable the extension service to extend these new systems to farmers.

COMMERCIAL POULTRY PRODUCTION

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November 3 - December 2, 1982

A. Summary and Recommendations

1. Recommendations

The following items, listed in priority order, are recommended for implementation of the poultry program. A detailed description of each item is included in Section C.

(a) Poultry farm management and marketing

(b) Feed quality assurance

(c) Egg processing and marketing

(d) Feeding poultry wastes as a ruminant protein source

(e) Meat processing and marketing

(f) Poultry by-products processing

(g) Supply of feed ingredients

(h) Egg marketing in village flocks

2. Description of the Study

The purpose of an in-depth study of the edible oil industry in Pakistan is to determine the feasibility of developing an expanded oilseed industry in the country to provide additional sources of oil for human consumption. Currently, about 700,000 tons of edible oil is consumed annually by Pakistan's 83,000,000 citizens. Approximately two-thirds of the total annual consumption is imported (about 460,000 MT) each year. These imports, from various sources, place a tremendous strain on the import-export balance, contributing heavily to the country's negative cash flow position.

An expanded oilseed industry with the potential of moving production nearer to consumption levels, would add greatly to the country's economy, have the potential for increasing agricultural income and aid in developing the supply of animal protein by providing by-products such as oilseed meal and oilcake for expansion of the poultry and livestock industries. The diets of the human population are deficient in animal proteins. Thus, an expansion in poultry, egg, milk and meal supplies would be beneficial to the overall health of the expanding population.

The purpose of this report is to review the current status of the commercial poultry industry and explore the effect and implications of an expanded oilseed industry on the future development of poultry, meat and egg production.

B. Detailed Description

1. Background: Commercial Poultry Production

The poultry industry in Pakistan before the mid-1960's consisted of rural or village household poultry flocks that were primarily scavengers and consumers of household wastes. Most were of the native "Desi" breed that would produce about 50 eggs each year and reach an average body weight of about 700 grams in eight weeks. These birds are apparently very hardy and disease-resistant.

Programs to improve the productivity of native birds have been developed by the University of Agriculture in Faisalabad. More recently, a rural poultry improvement program was initiated with the assistance of UNDP/FAO. These programs developed an improved native breed (Lyallpur Silver Black University). Four improved birds, i.e., Fayoumie, Dokki, Mini-red and Mini-white were introduced in the villages for pure breeding and upgrading the indigenous birds (UNDP/FAO project). In the latter project, the Fayoumi was universally reported to give the better results, with the Dokki and Mini-red reported as successful in some villages. The birds from both these projects apparently have production capabilities of about 120 eggs per year, or double that of the native "Desi" under village conditions. These native birds still comprise over 50 percent of the poultry flock in the country.

The commercial poultry industry in Pakistan started in the early 1960's. The first commercial hatchery was established in 1964 by Shaver Poultry Breeding Farms. This was followed by the Arbor Acres Pakistan, Ltd. in 1965, and with this start, the number of commercial hatcheries had increased to a total of 46 by 1981. The development of feed mills paralleled the hatchery development, and 28 mills producing primarily poultry feeds were in operation by 1981.

Commercial poultry production has made tremendous gains since the meager beginning in the 1960's. The total poultry population in the country for the past ten years is shown in Table 1. These data show the tremendous growth that has taken place.

The total population of poultry for 1980-81 is estimated at 67,169,000. From these data, it is evident that the growth rate has literally been "booming." The growth rate for all poultry was 264 percent, broilers 258 percent, layers 214 percent and native "Desi" 284 percent.

The commercial poultry population tends to be near the population centers of the country. Tables 2 and 3 show the poultry population in each of the four provinces.

Table 1

Poultry Population in Pakistan
('000)

Class of Poultry	1971-72	1976-77	1977-78	1978-79	1979-80	1980-81*
Broilers	4,769	10,217	11,848	13,740	15,933	18,476
Layers	1,713	4,431	5,138	5,958	6,909	8,012
Desi	10,850	21,696	25,158	29,174	33,830	38,230
Ducks	383	802	931	1,079	1,251	1,451
TOTAL	17,715	37,146	43,075	49,951	57,923	67,169

*Estimated.

Source: Pakistan Agricultural Data Book, June, 1982.

Table 2

Commercial Layer Population
('000)

Province	1971	1977	1978	1979	1980
Sind	580	2,059	2,679	2,797	3,485
Punjab	290	1,177	1,541	2,103	2,600
NWFP					
Baluchistan					
TOTAL	870	3,321	4,770	5,560	6,910

Source: Agr. Attache Report PK-2033, 10-5-82.

Table 3

Estimated Broiler Production by Province*
('000)

Province	1971	1977	1978	1979	1980
Sind (60 percent)	2,861	6,130	7,109	9,560	11,290
Punjab (34 percent)	1,622	3,474	4,028	5,417	6,397
NWFP (6 percent)	286	613	711	956	1,129
Baluchistan					
TOTAL	4,769	10,217	11,848	15,933	18,816

*Calculated from Table 1 and 1980 percent distribution, Report PK-2033.

Although the poultry population has been growing rapidly, present per capita consumption is very low compared with that of other countries. Egg consumption is 29 eggs per capita and poultry meat 0.46 kilos per person.

The commercial poultry industry in Pakistan was given its start by the establishment of hatcheries and breeding flocks by international poultry breeding firms (Shaver, Arbor Acres, Hyline, Ross and Piech) and aided greatly by the policies of the GOP during the 1970-75 period. These policies included (i) income tax exemption for poultry farming; (ii) import of parent breeder flocks duty free; (iii) import of poultry equipment duty free; (iv) allotment of state land on lease for poultry farming; (v) export of poultry products to eliminate surplus during slack demand periods; (vi) disease control programs; (vii) subsidy through UNDP grants; and (viii) reduced import duty on soybean meal from 40 percent to 10 percent to help produce better balanced rations.

A very thorough summary of the growth of poultry production from 1977 to 1980 was compiled by the Poultry Research Institute at Rawalpindi in Punjab Province. A copy of their summary is shown as Table 4.

2. Current Status

a. Poultry Industry Strengths

The rapid development of the commercial poultry industry in Pakistan has been possible due to a large number of factors that have encouraged or aided in promoting growth. These factors or "strengths" are still present, and the outlook for continued growth and improvement in the food industry is very encouraging. Some major strengths that will enable the industry to continue its present growth trends are:

(1) Consumption of Poultry and Eggs. Poultry meat and eggs are apparently readily acceptable to the average citizen and are included in most diets. Consumption on a per capita basis is very low (29 eggs and 0.46 kilograms of poultry meat), and is apparently limited by the amount of product available for consumption and the price of poultry relative to other meats. Poultry tends to be the highest priced meat, and its total consumption is undoubtedly limited somewhat by price. Current projections, however, indicate a need to increase production to meet the demand.

Table 4

Poultry Production Status in Pakistan

Sr.No.	Particulars	---1977---	---1983---	Percent Increase
1.	Investment in Poultry Farming Sector (Rs in million)	915.20	1,459.40	59.46
2.	Hatcheries			
	-Number	23	41	78.26
	-Capacity to Produce Day-old Chicks Per Annum (million)	35.32	52.84	49.60
	-Day-old Chicks Produced (million)	19.90	30.76	54.57
3.	Poultry Farms (number)			
	-Layer	1,450	2,030	40.00
	-Broiler	725	1,120	54.48
	-Breeding	30	55	83.33
	TOTAL	2,205	3,205	45.35
4.	Capacity to Maintain/produce Birds (million)			
	-Layer	4.25	7.17	68.70
	-Broiler	11.50	24.66	114.44
	-Breeding Stock	0.20	0.40	90.48
5.	Stock Maintained/produced (million)			
	-Layer	3.32	5.56	67.47
	-Broiler	8.01	17.42	117.48
	-Breeding Stock	0.17	0.31	82.35
	-Rural Poultry Population (million)	33.50	38.34	14.40
6.	Feed Mills			
	-Number	17	27	58.82
	-Capacity to Produce Feed Per Annum (million tons)	0.307	0.390	57.82
	-Poultry Feeds Produced (million tons)	0.129	0.207	102.94
7.	Poultry Products Produced:			
	Eggs (million)			
	-Farm	730.00	1,142.00	56.44
	-Desi	1,035.90	1,227.60	18.50
	TOTAL	1,765.90	2,369.60	34.19
8.	Poultry Meat (metric ton)			
	-Broiler	7,610	16,550	117.49
	-Culled Layer	2,660	4,450	67.25
	-Desi	14,900	17,040	14.36
	TOTAL	25,170	38,040	51.13
9.	Per Capita Availability of Poultry Products			
	-Eggs (no.)	23.36	28.69	22.82
	-Poultry meat (kg.)	0.33	0.46	39.40

Source: Poultry Research Rawalpindi.

(2) **Demand Projections.** The Ministry of Food and Agriculture of the GOP has estimated that the demand for poultry and eggs is nearly double the supply. If this demand were met, the number of broilers should be increased from the current production of around 18 million to over 47 million, and the number of layers increased from eight to over 14 million. Native "Desi" fowl should increase in numbers from the present total (males and females) of around 39 million to over 55 million. Attached in Table 5 is a summary of the present production and the estimated demand as presented in the Pakistan Agricultural Data Publication, 1982.

Table 5

Estimated Poultry Production (1980-81) and Demand Projections (1984-85)
('000)

Class of Poultry	198 -81 Production	1984-85 Demand
Broilers	18,476	47,800
Layers	8,012	14,210
Desi Layers	25,250	31,570
Desi Cocks	13,980	24,100
Total Desi	39,230	55,670
Ducks	1,451	
TOTAL	67,169	117,680

Source: Pakistan Agricultural Data Book, June, 1982.

(3) **Price of Poultry Relative to Other Meats.** Current prices of poultry meat are very favorable relative to other meat sources for encouraging industry growth. Broilers averaged 14.77 Rs/kg live weight in Pakistan in 1981. This live weight price would be equivalent to about 23 Rs/kg of dressed weight, assuming a 65 percent dressing percentage for the Pakistani bird that is skinned rather than scalded and picked. This compares with 10-14 Rs/kg for dressed beef and about 20-24 Rs/kg for dressed mutton.

(4) **Availability to the Average Family.** Poultry is available to the average rural family in Pakistan as most families have native birds as home flocks. The birds are also sold live in the markets and custom dressed for the consumer. Individual birds can be dressed or purchased for family consumption on the day desired,

but storage is a problem when large animals are slaughtered for home consumption. Although poultry is higher in price relative to other meats, the convenience of the small bird is a major advantage where refrigeration is generally unreliable and storage is a problem.

(5) **Government Incentives.** Exemption from government income tax, duty free imports and subsidy of disease control and vaccines are major factors in stimulating expansion of the industry.

b. Production Constraints or Weaknesses

In view of the rapid growth of the poultry industry, one might assume there are few or no obstacles to impede further progress. This, however, is not the case, and a number of constraints tend to hamper growth. Constraints influencing industry progress are as follows:

(1) **Seasonal Demand for Poultry Meat and Eggs.** The average Pakistani consumer apparently prefers to eat larger quantities of poultry and eggs during the fall, winter and spring months, with a definite decline in consumption during the hot summer months. This summer decline causes great reduction in prices, and farmers tend to sell egg-producing flocks and reduce broiler production. Since egg production flocks are sold at the start of summer, replacement stock must be started in the spring for new flocks to start production in the fall.

This seasonal pattern of egg production places great demand on the hatcheries for chicks during the spring season and less demand at other times. Breeder flocks and hatcheries are pressured to meet the spring demand for egg-type chicks and winter demand for broilers. All of these factors tend to result in great fluctuations in price and quality of chicks and eggs.

(2) **Quality Chicks.** The seasonal production and consumption patterns discussed above, tend to result in poor average chick quality and high prices during greater demand periods and little or no demand and poor prices during other seasons. This results in price inflation, setting poor quality eggs and hatcherymen selling everything that hatches during high demand periods. The poor quality of chicks undoubtedly results in some of the higher-than-average mortality rates experienced by the Pakistan industry.

(3) **Feed Ingredients.** Commercial poultry flocks must receive a constant supply of concentrate-type diets that

are nutritionally balanced for optimum production. The supply of feed ingredients in Paksitan is quite variable, and nutritionists have a difficult time formulating adequate diets to support the industry. Feed costs make up 55 to 75 percent of the cost of producing poultry. Fluctuating supplies and associated variations in ingredient prices have a great effect on industry profitability.

(4) Feed Quality. Quality feed ingredients are a "must" if feed mills are to produce quality finished feeds. Neither the Pakistan central government nor the provincial governments have feed laws or regulations that control the quality of feed ingredients or mixed poultry feeds. Since the supply of ingredients is limited, everything is sold, good and bad, resulting in poor quality. Molds and aflatoxins often are found in many ingredients that are in substandard storage. Also, on average, great variability exists in poultry feeds produced by various mills. Thus, the poultry producer has no assurance he is purchasing an adequately balanced diet.

(5) Disease Control. Mortality rates among commercial poultry flocks in Pakistan are much higher than normally expected in commercial operations. Reports from producers and research personnel indicate commercial egg producers normally experience 30 percent mortality in their flocks, with about 12 percent occurring during the 16-week growing period and 18 percent during the 60-week laying period. Mortality in broiler flocks is reported to average around 15 percent, with cases as high as 30 to 50 percent reported.

Vaccines are currently being produced by the Provincial Poultry Research Institutes and distributed on a subsidized basis to poultry producers. Vaccines are difficult to administer to village flocks so non-vaccinated birds tend to serve as a reservoir of infection.

The presence of aflatoxins and other toxic agents in feed ingredients and mixed feed undoubtedly contribute to the high mortality and morbidity rates. Reduction in current mortality rates probably offers the greatest potential for reducing costs of producing both eggs and meat.

(6) Government Policies. The GOP has taken positive steps to encourage the development of both the commercial and village poultry industries. Additional involvement is urgently needed in the area of feed quality control regulations to ensure a constant supply of high-quality, unadulterated feed ingredients.

3. Major Impediments to Change/Programs

The major impediments to change and improvement are outlined in Section B.2.b. above, and recommendations are made for each of these items in more detail in Section C of this report.

4. Assessment of Priorities for Change

An evaluation of the commercial poultry industry in Pakistan indicates tremendous growth in a short period of time and great potential for further growth. The recommendations made in this report as listed in summary form in Section A.1. above and in detail in Section C are listed in recommended priority order. The poultry farm management program was given first priority because improvement in this area should give a greater immediate return on investment of time and money to the industry and to the people of Pakistan. The other items in the priority listing are very important for the development of the poultry industry and the development of an expanded oilseed industry.

C. Project Analysis: Areas of Potential Program Emphasis

The major objective of developing an expanded oilseed industry in Pakistan would be to expand the amount of edible oil available domestically for human consumption. Currently, about two-thirds the oil consumed is imported (460,000 MT). With the population and income growth, demand is expected to increase accordingly. The development of an expanded oilseed industry, regardless of the oilseed crop selected for expansion, should be accompanied by a corresponding increased use by the commercial poultry industry of by-product oil meal, first as a protein source and second as an energy source. The development of this industry should also contain objectives to aid in the development of commercial poultry. The two industries are complementary.

It is recommended that the following items be considered as major components of the master project.

1. Poultry Management

a. Situation

Current levels of poultry management and disease control result in extremely high mortality levels in both broilers and layers. Reports cited earlier in this study indicate mortality levels averaging 30 percent in commercial layers and 15 percent in broilers. These levels are extremely high, and a good poultry management education program should enable the industry to reduce mortality levels by at least half. Good quality

poultry vaccines are apparently readily available from the research institutes. If administered properly in well-managed operations, these goals should be attainable.

b. Recommendations for Implementation

A technical assistance program and quality check program listed below, with the assistance of expatriate personnel trained in poultry management. To be effective, the assistance should be in the major production areas.

c. Fiscal

(1) Technical assistance program in the Sind, Punjab and the NWFP to develop a poultry management program with breeder, hatchery, broiler and egg production flocks.

(2) Problem-solving research program in cooperation with the respective provincial research institutes.

(3) Educational training program for selected extension workers and poultry farm managers in international institutions. This program should be practical and could be accomplished in about three months. It is recommended that a program of this type be set up with an institution that would arrange a short course plus practical industry farm experience.

2. Need for Quality Chick Supply

Adjustments in poultry production patterns in Pakistan by shifting production to a year-round basis should remove the majority of constraints currently contributing to the poor quality of chicks available to poultrymen.

a. Recommendations for Implementation

A quality chick program to educate commercial poultrymen should be initiated with the help of expatriate personnel trained in poultry management. This technical assistance program should be for the major production areas.

b. Fiscal

(1) Technical assistance program in the Sind, Punjab, Baluchistan and the NWFP to increase chick quality, reduce mortality and increase the overall level of poultry management in breeder, hatchery, broiler and egg production flocks.

(2) Problem-solving research program in cooperation with the respective provincial research institutes.

(3) Educational training programs conducted at the same time as the farm management program listed in item 1. above.

3. Feed Quality Assurance

The quality of feed ingredients is probably the largest single factor affecting the development of a profitable commercial poultry industry. Currently, as reported in Section B.2.b.(4) above, there are no feed quality laws or feed regulatory agencies authorized at either the central or provincial government levels for controlling the quality of the feed ingredients or the finished mixed feed. Official standards should be developed for each major feed ingredient to ensure the purchaser is receiving a standard or normal ingredient that meets minimum requirements for nutrients usually assayed in the approximate analysis. For example, a given oilseed meal should have a standard set for maximums on moisture content and crude fiber and minimum levels of crude protein percentage, ether extract (fat) percentage and mineral-level percentage.

Likewise, laws or regulations should be established to require the feed manufacturers (feed mills) to report to the purchaser (producer) the minimum and maximum levels of each class of mixed feed. The first proposed regulation would protect the feed mill to ensure that quality ingredients are available, and the latter regulation would protect the final purchaser to ensure that he was receiving the quality of mixed feed he purchased. In addition to establishing standards, the government should initiate a feed regulatory agency or system to ensure standards and guarantees were being met. This agency should sample both ingredients and mixed feeds, check analyses and handle complaints.

a. Recommendations for Implementation

The implementation of this recommendation will undoubtedly require either new laws or regulations developed by an existing government agency that has the authority to regulate the feed industry. Donor agencies could assist by providing short-term consultants to work with government agencies to develop feed laws appropriate for Pakistan's industry and longer-term technical assistance to help train feed control officials and field personnel. Some monetary assistance may be needed to help establish feed control laboratories and to provide assistance to the research institutes to establish standards for feed ingredients produced in Pakistan.

b. Fiscal

(1) Short-term consultants for developing feed regulations.

(2) Long-term technical assistance for implementing programs and training personnel in Pakistan.

(3) Educational training program in an international institution to train selected feed control officials in feed quality control work. It is recommended that these programs consist of three to six months of practical on-the-job training with feed control laboratories and feed staff.

(4) Funds for laboratories and analyses to establish standards.

4. Egg Processing and Marketing

The seasonal decline in egg consumption during the summer months and the corresponding compounding effects of poor chick quality causes great supply and price fluctuations. Seasonal sell-off and replacement of laying flocks create many problems for the egg producer. Programs should be developed to equalize the demand for eggs throughout the year. This would permit more efficient use of breeder flocks, reduce the required number of breeders, contribute to improving chick quality, help stabilize meat production and related price fluctuations and improve overall efficiency of the entire industry.

a. Recommendations for Implementation

It is recommended that egg processing plants be developed in the major egg production areas (population centers) to utilize eggs during low demand periods. These plants could be started on a reasonably small scale and operated on a seasonal basis until the concept became established as an integral part of the industry. Products could include liquid whole eggs, albumen, yolks that could be produced either on a fresh or frozen basis and dried albumen, yolks and whole eggs. In many countries these products are readily accepted by institutional users of eggs such as bakeries, mayonnaise and salad dressing manufacturers, ice cream manufacturers and baby food producers. Drying of egg components also should be included in these processing plants to produce dried products for the same markets, extend storage periods and reduce transportation and storage of the processed products.

A joint venture of private industry is recommended for initiating a pilot plant, preferably in the Karachi area where the layer population is high. This joint venture, with donor loan support and government subsidy, will help encourage production during low

consumer demand periods. It should include the development of a plant and storage facilities, a program of procurement for a supply of eggs and a marketing program to establish the use of the products in institutional areas.

b. Fiscal

(1) Joint venture of a donor and Pakistan private industry individuals to establish and operate an egg processing plant.

(2) Donor loan support to help construct the plant.

Building approximately 40'x100': receiving room (20'x25'); egg cooler (20'x25'); breaking room (20'x25'); drying room (40'x25'); refrigerated storage (12'x20'); freezer storage (12'x30'); dry storage (20'x25'); office, etc. (20'x25').

Egg breaking equipment-hand operators.

Egg drying equipment: spray dryer; pan dryer; trucks and equipment for delivery.

(3) Expatriate advisor to help develop procurement and marketing programs. This individual should be trained in poultry marketing.

5. Feeding Poultry Wastes as a Protein Source

a. Situation

Pakistan has nearly eight million commercial layers and 18 million commercial broilers that produce about a quarter (100 grams wet basis) of the poultry waste per bird per day. This waste or manure is very high in nitrogen (protein) as the avian species excretes uric acid in a semisolid state rather than liquid urine as in mammals. Ruminant animals are capable of using this uric acid nitrogen as efficiently as they use other non-protein sources such as urea. The current practice of the commercial poultry farmer is to dump or dispose of this waste. The concentration of poultry farms and many buffalo colonies are in the fringe areas of urban centers. With this close proximity of herds and flocks, the use of poultry wastes should be developed as a feed ingredient for ruminant animals.

b. Recommendations for Implementation

It is recommended that a program be developed with the cooperation of a group of commercial poultry, buffalo or cattle farmers to demonstrate the feasibility of using poultry waste as an economical source of non-protein nitrogen. This program should use expatriate technical assistance, funds and training where necessary. It should include feed formulations for incorporating the waste of both layers and broilers with fodder, and possibly molasses, in direct feeding programs. It should also develop formulas for incorporating waste from both classes of poultry in silage for storage and feeding. Silage may offer the best method of incorporating and introducing this concept for feeding ruminants. However, direct feeding has proven effective and acceptable to the animals.

c. Fiscal

(1) A donor technical assistance program involving a knowledgeable individual trained in nutrition, with experience in husbandry, to set up a demonstration research program in cooperation with one of the research institutes. The program should involve the development of practical formula for using poultry wastes directly and in silage and demonstration research to introduce the concept for cattle and buffalo herds. This program could be a pilot unit in one province.

(2) Research budget to establish a demonstration unit.

(3) Mixing equipment for handling direct feeding studies and making silage.

6. Poultry Meat Processing and Marketing

a. Situation

The usual preference in the Pakistani home, primarily by the low income consumer, is for mutton, with beef as a seond choice and poultry on special occasions or as a "meatless day" food. The average consumer in Pakistan has a preference for purchasing live birds in the village market which is then custom-dressed for prompt home cooking. This system makes fresh poultry available to any family on any day without any refrigeration or storage. This system works well for the family; however, the needs of institutional consumers of poultry meat such as hotels and restaurants, hospitals, cafeterias and military installations would utilize poultry processed in specialized processing plants.

Although no official statistics are available, it is estimated that at least 50 to 60 percent of the per capita poultry meat consumption is through the institutional route. If this assumption is correct, about half the production of 18 million birds

could be processed commercially for institutions, supplying them poultry in a more usable form. In addition, a processing plant could custom cut for a particular market, increasing income by providing these additional services.

b. Recommendations for Implementation

A joint venture approach is recommended with a private donor firm and a private Pakistani firm to establish a processing and marketing operation in a major population center. Poultry processing should be started in Punjab Province if egg processing is to be located in the Sind. However, the most economical site should be selected to ensure a viable operation.

The plant should, if possible, include cooperation with a major integrated poultry firm to ensure a steady supply of poultry for processing and the development of a marketing program to establish the processing concept and its effectiveness for institutional consumers. In addition, the plant should be located near an existing rendering plant whose by-products (feathers, feet, heads and viscera) can be processed into meat meal for use in poultry or animal feeds. If this situation is not possible, the processing plant should include a rendering plant that could efficiently process by-products.

c. Fiscal

(1) Joint venture of donor and Pakistani private industry to establish and operate a poultry processing plant. Donor loan support to help construct a plant.

> Building, 80'x100'; processing equipment: killing room, eviscerating room, scalder, picker, cut-up area, packing; ice making and refrigeration equipment; small freezer capacity--1, 20'x30'; trucks and delivery equipment.

(2) Technical assistance to develop procurement and marketing programs.

7. Poultry By-product Processing

Poultry processing in Pakistan is handled in village or urban markets, and most by-products (viscera, blood, skin, feathers, some head parts and feet) are apparently disposed of in garbage dumps or in sewers rather than utilized as a valuable by-product. The by-products are valuable as meat, blood and feather meal for use as a high-protein supplement in poultry and livestock feeds. Also, the collection and use of these products would decrease human health problems brought on by improper disposal methods.

a. Recommendations for Implementation

It is recommended that a pilot program be developed in urban areas where rendering plants exist to establish collection routes for collecting and assembling poultry processing wastes, meat processing wastes and dead bird disposals for rendering into useable meat meal by-products.

b. Fiscal

(1) A cooperative technical assistance program with a provincial government, donor loan and a private rendering plant to set up a pilot program for collecting and handling the poultry and meat processing wastes and dead birds from commercial farms in urban areas.

(2) Vehicles and containers for collection and sanitary transport of wastes.

B. Supply of Feed Ingredients

A continual supply of high-quality feed ingredients is essential to support a profitable commercial poultry industry. The development of an expanded oilseed program should add to the supply of protein, and the implementation of a feed quality control program as outlined in section C.2. above, should help to standardize quality. The industry is currently formulating poultry diets using a large number of protein and energy sources. Should the industry continue its present growth trends, an increase of 90,000 metric tons of additional protein ingredients and 200,000 tons of energy feeds would be needed by 1985. A projection of these needs for feed ingredients is presented in Table 6 for industry growth in line with current proven demand projects. (Typical formulas for poultry diets are attached in Table 7.)

This increased growth of poultry,coupled with projected increases in the use of concentrate diets for other classes of livestock, will undoubtedly place a severe strain on the available supply of feed ingredients. If one assumes tha protein needs can be met through the expanded oilseed program, an increased program emphasis on the production of "energy" ingredients will be needed.

a. Recommendations for Implementation

Develop a technical assistance program in the major crop-producing areas of Sind, Punjab, Baluchistan and NWFP to increase the production of maize, sorghum and other high-energy crops. This program should probaly be developed as a second stage or phase of the oilseed project, as the demand for energy ingredients should follow the expansion of protein sources.

Table 6

Projected Poultry Feed Needs for 1985
(Metric Tons)

Protein Needs	---1980---	----1985---
Broilers	19,600	51,500
Layers	69,000	127,000
TOTAL	88,600	180,500

Energy Needs		
Broilers	42,500	112,000
Layers	150,000	279,000
TOTAL	192,000	391,000

Table 7

Typical Poultry Feed Formulas Used in Pakistan, 1982

	--Broiler Diets--		------Layer Diets------		
Feed Ingredient	Starter (%)	Finisher (%)	Starter (%)	Grower (%)	Layer (%)
Rice	15.0	16.0	18.0	16.0	14.0
Wheat	20.0	10.0	9.0	19.0	10.0
Rice Polishings	20.0	20.0	20.0	20.0	20.0
Maize	6.0	20.0	20.0	18.0	25.0
Corn Gluten	4.0	3.0	5.0	3.0	
Fish Meal	6.0	6.0	5.0	4.0	5.0
Meat Meal	7.0	6.0	6.0	4.0	5.0
Blood Meal	3.0	3.0			
Cottonseed Meal	7.0	4.0	5.0	3.0	3.0
Rapeseed Meal			2.0		
Guar Meal	4.0	4.0	4.0	6.0	8.0
Bone Meal	1.0	1.0	1.0	1.0	1.0
Limestone	1.5	1.0	1.0	1.5	5.5
Fat (animal)	2.0	2.0			
Molasses	3.0	3.5	3.5	4.0	3.0
Vitamin pre-mix	0.5	0.5	0.5	0.5	0.5
TOTAL	100.0	100.0	100.0	100.0	100.0

b. Fiscal

(1) Donor long-term technical assistance (agronomic) to develop programs.

(2) Funds for field research and demonstration of new rotational schemes, multicropping systems and development of potential areas for crop production.

9. Egg Marketing from Village Flocks

a. Situation

More than half the total poultry population in Pakistan is in rural or village poultry flocks and contributes both eggs and meat for human consumption. The village flocks produce about 45 eggs per bird each year which makes up about one-third the total eggs produced in the country. A rural poultry improvement program has been operating under the sponsorship of UNDP/FAO to improve these village flocks by introducing improved breeds capable of producing 100-120 eggs per year in the village environment. This program has been very successful from all reports, and the introduction of improved breeds such as the "Fayoumi" and "Dokki" have contributed to the program's success. It has been estimated that 100,000 birds have been released during the five years the program has been operational. Any surplus eggs from village flocks are sold to local merchants for resale.

b. Recommendations for Implementation

It is recommended that a technical assistance program be established in cooperation with the Poultry Research Institutes in Sind, Punjab and NWFP to work with village producers to establish marketing programs for surplus eggs. These marketing programs should follow the pattern of the milk collection stations with egg collection points in the villages (within a radius of a central market point) and the establishment of a mrketing program in urban areas. The critical points of such a production and marketing scheme might include the following:

1. Continue the village flock improvement program under the sponsorship of UNDP/FAO, if possible.

2. Expand the village flock program to include a sire improvement program. This could be developed in conjunction with the research institutes to hatch and grow males of the "Fayoumi" and "Dokki" breeds for release on a trade basis (male for male) with village producers. These improved males, when introduced in the village flocks, should leave offspring that would have

superior egg production to the native "Desi," but retain some of the indigenous disease resistance.

3. Organize village poultry (livestock) associations that can set up collection points for assembling surplus eggs.

4. Organize a marketing association to handle the eggs assembled by the village collection points and handle the marketing in central markets and institutional areas.

5. Develop educational programs and extension-type efforts to promote the production of "clean eggs" and to maintain egg quality from the farm to the consumer. Poultry management should be included in these educational efforts.

c. Fiscal

(1) Donor technical assistants trained in extension poultry science and marketing to set up marketing and village flock associations and establish village collection stations. These technical assistants also should set up educational programs in flock management, disease control, egg quality and marketing.

(2) Financial support for trucks, egg coolers, central assembly points, egg graders, filler flats and cases for egg handling.

D. Evaluation Plan

The poultry phase of the project will be evaluated by comparing present industry production parameters with their value at specific time intervals during the progress of the project.

E. Policy Commentary

1. Government of Pakistan Perspectives

The GOP has a number of policies that have been favorable to the development of the poultry industry. These have been described in Section B.1. Recommendations are included in this report that would require GOP action. These are the development or enforcement of feed quality standards outlined in Section C.4.

Poultry management and disease control in the poultry flocks is a major problem and the GOP needs to place a major emphasis on

producing quality vaccines for disease prevention and educational programs to help improve management levels.

2. Donor Country Perspectives

Pakistan imports large amounts of palm oil from Malaysia and some soybean oil from Europe. It exports oil meal from rape and rice bran to Japan and a number of European countries. Self-sufficiency in oil production is not likely to be developed quickly, so imports of oil will, by necessity, continue for some time. Palm oil imports are likely to be some of the first to be reduced as oil production increases, because palm oil is one of the least desirable oils from a health standpoint.

SMALL FLOCK POULTRY PRODUCTION

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A. Summary and Recommendations

1. Recommendations

The following recommendations are listed as items for priority action in the implementation of a poultry development program.

a. Provide technical assistance to train field staff for teaching poultry husbandry and management to various segments of the industry.

b. Provide technical and financial assistance for research in the existing institutions doing poultry investigations.

c. Provide technical assistance for the establishment of industry feed-testing laboratories.

d. Provide technical assistance to the poultry industry for marketing and consumer education.

2. Summary

The increased production of edible oils and fats in Pakistan would require a need to develop a market for oilseed residues. Poultry feed has been used in other countries for this purpose. This segment of an overall, in-depth study to seek ways to increase edible oil production was conducted to determine priorities for action to expand small flock production in Pakistan.

About one-half of the national poultry flock is composed of scavenger chickens. They do not constitute a market for oilseed residues. However, a UNDP/FAO rural poultry development program has prepared an infrastructure that could provide management training which would stimulate an increase in flocks of 100 to 2,000 birds. In addition, there is a suitable market ready for expansion, a commercial industry operating under capacity and basic research facilities--all ready to be used for development. The basic ingredients are present for small flock growth.

B. Detailed Description

1. Background

Estimates in 1980-81 indicate approximately one-half of the poultry population in Pakistan is comprised of scavenger (Desi) birds in flocks of five to 25 each. Rural poultry is cared for by the women and children of the household. The birds are brought in for the night and may be confined during the early

morning until laying is completed. No nests are provided and the incidence of dirty eggs is high. Usually, some coarse grain is fed at morning and evening during the winter, with scavenging in between. In some severe instances, sales from these flocks account for 50 percent of the family's weekly available cash. Thus, most scavenger-produced poultry and eggs are used for cash income rather than home consumption.

Considering the remoteness of farm location, marketing these products may involve three to nine direct transactions before reaching a point of consumption. There may also be several lateral sales to further lengthen the market chain. Thus, time to market may vary from three to 21 days. This is not too serious for poultry because they are sold live and do not suffer from heat spoilage. In summer, however, fertile eggs continue to incubate and may reach the three-day blood ring state before embryos die. Coupled with microbial contamination due to dirty shells, these kinds of spoilage may account for some of the alleged consumer resistance to eggs in the hot season. Other low periods for egg and poultry marketing are the winter school break, Ramadan and Muharram. During the school break, the children eat at home, so they do not have an egg sandwich for a school lunch. The fast of Ramadan also alters regular egg and poultry consumption habits. Muharram cuts consumption due to the ban on weddings and their celebrations. Seasonal production does not help either.

The bulk of the eggs are produced in January to June when natural reproduction takes place. This process is stimulated by the lengthening of the day. Excess males add to the meat supply from March through August. Distance, time, culture, seasonality, climate and spoilage contribute to considerable markups in price. In interviews, markups of 50 to 150 percent were reported. In general, markups are greater in the winter when demand is highest. All these factors contribute to a volatile market situation for both the scavenger and commercial producers.

Government taxing and price control practices also disrupt a smooth and orderly flow of poultry products through the national marketplace. It is a common practice to placate consumers by fixing prices on foodstuffs, including eggs and poultry. Too often these prices have been below the cost of production and/or marketing. The net effect has been a reduction of eggs and poultry in the marketplace. Also, there is the practice of local jurisdictions taxing the movement of eggs and poultry across their borders. This prevents the stabilizing effect of moving products from a surplus to a deficit market.

Newcastle and coccidiosis are endemic in the poultry population. Fortunately, there are vaccines to control them, although village authorities question a program requiring the purchase of chicks because of these diseases.

2. Current Status

At present, rural scavenger flocks do not constitute a market for oilseed residues. The owner does not need to buy feed. Even if they were so inclined, the cost of preparing and transporting small quantities of feed for five to 25 birds would be prohibitive. It is necessary, then, to convert some of these owners into keepers of poultry as a secondary source of income.

In 1977, UNDP/FAO began a program of rural flock improvement and vaccination. Termination of UNDP/FAO support is scheduled for June or July of 1983. This project distributes primarily the Fayoumie and Rhode Island Red breeds to small farmers, carries out a village newcastle vaccination program and conducts paraprofessional and village training programs. Its objectives are to improve the genetics, health and management of scavenger flock production. Under farm conditions, Fayoumie and Rhode Island Red hens have lived well and have produced up to 120 eggs, compared with 50 to 60 by the Desi birds. The program has been successful in areas it has reached. Its potential for change is marginal, however, due to its limited capacity to produce started chicks.

Because of its comprehensive approach, the program of poultry development in the Punjab has been the most successful (Table 1). The program has both rural and commercial development projects that are well-coordinated in the use of administrative and field staff. The net result is a strong working relationship between government and commercial producers. This element of cooperation and trust between government and industry was not as evident in the other provinces.

Table 1

1982 Status and UNDP/FAO Rural Poultry Improvement Program

Province	----1,000---- No. of Chicks Distributed	No. of Hatcheries	---1,000--- Potential Eight-week Chicks/Year[1]	---Million---- No. of Poultry Vaccinated	Feed Mills	--Tons--- Potential Feed/Year[2]	Villagers Trained
Azad Kashmir	78.3	4	232.0	4,248	2	7,680	596
Baluchistan	7.6	3	302.4	752	2	7,680	2,875
NWFP	26.9	3	235.2	3,092	1	3,840	64
Punjab	264.4	6	806.4	9,942	1	3,840	1,080
Sind	16.0	5	472.0	1,882	1	3,840	87
TOTAL	393.2	21	2,248.0	19,916	7	26,880	4,693

[1]Forty-eight weeks of operation at 70 percent yield of eight-week started birds.
[2]Forty-eight weeks of production, five-day week, 16 tons/day/mill.

Source: Unpublished data, Poultry Research Institute, Rawalpindi.

The sale of Fayoumie and Rhode Island chickens has been well received. Their desirability rests in their egg numbers and livability under scavenger conditions (Table 2). In the Punjab, some farmers have purchased flocks of one to two hundred birds. These are maintained under semi-confinement and are fed manufactured feed. Under these conditions, the farmers become actively engaged in the enterprise. If this practice grows, small flocks will constitute a market for 10, 20 or 40 kg bags of feed. This transition away from scavenger flocks should be encouraged. It could easily become the focal point of the rural poultry development program.

Table 2

Performance of Fayoumi Birds Under Scavenger Conditions

	Confinement	Scavenger
Percent Mortality to 78 Weeks	10	18
Bird Yearly Egg Production	200	160
Desi		50-60

Source: Poultry Research Institute, Karachi.

Apparently, the UNDP/FAO program has made progress, particularly in the Punjab. In other areas, progress is painfully slow. In 1981-82, it is estimated that the UNDP/FAO program placed about 393,200 started birds--about 1.0 percent of the yearly 38 million rural poultry population. However, the program's greatest potential for development of commercial production is in farmer education and newcastle vaccination. This could accelerate the transition from scavenger to commercial flocks of 100 to 2,000 birds.

a. Rural Poultry Industry Strengths

Technically, there are five criteria on which to evaluate industry potential. They are: (1) access to a suitable market; (2) acclimated genetic material and the ability to multiply it; (3) quality feed supply; (4) technically competent industry personnel; and (5) research and development for new technology. In Pakistan, the basic elements of these criteria are in place:

1. There is a suitable market for Desi and commercial products. Actually, Desi products bring a premium price in the market, usually one to two rupees per

dozen eggs and two to four rupees per kilo for poultry. Demand estimates (Table 3) indicate a need for greater production of all poultry products.

Table 3

Estimated Poultry Production (1980-81) and Demand Projections (1984-85) (1,000)

Class of Poultry	1980-81 Production	1984-85 Demand
Broilers	18,476	47,800
Layers	8,012	14,210
Desi Layers	25,250	31,570
Desi Cocks	13,980	24,100
Total Desi	39,230	55,670
Ducks	1,451	-
TOTAL	67,169	117,680

Source: Pakistan Agriculture Data Book, June, 1982.

2. Through the UNDP/FAO project, there are basic staff and facilities in place to supply (i) producer technical training, (ii) bird vaccination and (iii) research and development labs. The Agriculture University at Faisalabad also provides professional training and research capability. Commercial companies can provide improved stock and feed.

3. The above resources provide the core of necessary staff and technology for development of the industry as a whole. The rural development program can be an instrument for conversion of scavenger flocks to commercial flocks that use manufactured feed and baby chicks. New technology suited to Pakistani conditions can result from the research facilities.

b. Constraints or Weaknesses

The basics for rural and commercial poultry development are present in the country. There are, however, some areas that need encouragement or greater support.

1. The village poultry education or training segment of the program and newcastle vaccination should receive greater emphasis. From Tables 1 and 4, it can be seen that the potential for significant replacement of the Desi flock through the breeding program is very low. In any one year, all of the UNDP/FAO hatcheries operating at full capacity could produce about 2.2 million started Fayoumi and Rhode Island Red (RIR) chicks. If the size of the Desi flock remained constant at 38 million, the improved birds would make up only six percent of the total population. Also, improved stock would be concentrated in areas around the hatcheries. The net effect is slow genetic improvement of the widely scattered Desi flock. Through technical training and control of newcastle by vaccination the climate for commercial production in rural areas would be improved. This would mean putting more extension people in the field, particularly women.

Table 4

Poultry Population in Pakistan
(1,000)

Class of Poultry	1971-72	1976-77	1977-78	1978-79	1979-80	1980-81*
Broilers	4,769	10,217	11,848	13,740	15,933	18,476
Layers	1,713	4,431	5,138	5,958	6,909	8,012
Desi	10,850	21,696	25,158	29,174	33,830	38,230
Ducks	383	802	931	1,079	1,251	1,451
TOTAL	17,715	37,146	43,075	49,951	57,923	67,169

*Estimated.

Source: Pakistan Agriculture Data Book, June, 1982.

2. Feed manufacturers report feedstuffs are in short supply and poultrymen complain about poor nutrient quality. These are major constraints to poultry development in Pakistan.

   a. There is a short supply of good quality protein feedstuffs. The proposed increase in oilseed production would reduce this deficit. However, the most critical ingredient is food energy to utilize the protein. Coarse grains and feed-grade fats used for energy in poultry diets are even less available than protein sources.

b. A nutrient analysis was made of a broiled diet suggested by the Poultry Research Institute, Karachi (PRI-K), using their values and those of the National Research Council/National Academy of Sciences (NRC/NAS). Comparison with standard requirements from both institutions confirms that diets are low in energy and lack amino acid balance (Table 5).

Table 5

Comparative Nutrient Analysis of a Broiler Starter Ration*

	METB Energy KCAL/KG	Minimum Requirements (Percent)				
		Protein	Lysine	Methionine & Cystine	Threonine	Tryptophane
PRI-K	3,000	22	1.2	0.82	0.77	0.22
NRC	3,200	23	1.2	0.93	0.75	0.23
		Diet Analysis (Percent)				
PRI-K	2,913	21	1.06	0.69	0.86	0.17
NRC	2,865	23	0.95	0.73	0.73	0.21

*Values from the Poultry Research Institute, Karachi, the National Research Council and the National Academy of Science, Washington, D.C.

Source: M. H. Sadiq and C. B. Seng, Indigenous Feedstuffs Commonly Used in Poultry Feeds, 1982.

c. The feed quality problem can be addressed only through a strong research and development program in poultry nutrition. Presently, there are several public feed analysis labs in the country. The Poultry Research Institute, Rawalpindi (PRI-R), PRI-K and the Agricultural University in Faisalabad were visited. The work at these institutions has dealt primarily with genetic acclimation of breeding stock for scavenger flocks, approximate analysis of feedstuffs, feeding trials on indigenous feeds and production of vaccines. Most of the effort at Karachi and Rawalpindi, however, has been aimed at the UNDP/FAO rural development program because the program was their source of funding. Except for approximate analysis work, not much appears to have been done in cooperation with the commercial industry.

(1) There appears to be no incentive mechanism to stimulate research. Senior staff comment on the

lack of funds for facilities, equipment, operations and maintenance. Administrators lament over a promotion system that does not take productivity into account. Also, opportunities for professional improvement are limited. These factors, combined with the lack of a coherent system for determining research priorities, make it easily understood why the industry struggles with poor feed quality and husbandry.

(2) Federal funding is administered by the Pakistan Agriculture Research Council (PARC) which maintains its own facilities and staff. Provincial investigators can submit proposals for projects to be carried out through PARC facilities. It is encouraging that productivity of the investigator is one criterion for acceptance. However, funding for junior staff development is difficult to find, and there is little federal support for provincial labs, i.e., Karachi, Rawalpindi and Faisalabad.

(3) Libraries are not as up-to-date as they should be. Annual subscriptions to scientific journals and current reference materials are not maintained because of foreign exchange restrictions. Investigators and educators cannot function properly without these pertinent materials.

(4) Annual professional society meetings are needed. This would help coordinate poultry research, provide professional improvement, stimulate intellectual development and increase productivity.

4. The number of technically qualified people throughout the industry is inadequate to the need. There is a nucleus of excellent people in both the public and private sectors who can maintain current levels of performance. However, as the industry grows, the efficiencies for profitability will have to come from a broader base of highly trained people. For example, (a) the conversion of keepers of scavenger flocks to commercial production will require more and better trained extension people; (b) feed efficiency will improve with better qualified ration formulators in feed mills; and (c) flock performance will improve with better trained managers and attendants.

5. At present, poultry and eggs can be marketed at a profit because demand generally exceeds supply by a wide margin. There are, however, marketing problems due to disrupted production and replacement schedules and difficulties in price discovery for producers. These problems are related to the hot season and cultural practices. As production approaches demand, these marketing problems must be solved.

6. There are established marketing routes with areas of concentrated production developing along them. These are illustrated in Figures 1 and 2. Poultry and eggs tend to concentrate in the markets of Islamabad-Rawalpindi, Lahore and Karachi. Lahore appears to be the pivot market, while Karachi is the terminal. Poultry and eggs for export leave through Karachi and in minor quantities from Quetta and Peshawar. Commercial production is centered around Islamabad-Rawalpindi, central Punjab (Lahore-Faisalabad-Multan) and Karachi-Hyderabad. This is evidenced by a large number of feed mills and hatcheries in these locations.

Some problem areas include (a) the need for consumer education to make them aware of the nutritional quality and appropriateness of poultry products year-round; (b) the number of middlemen who handle scavenger flock products before they reach a major market; (c) the imposition of price controls that do not provide a profit to producers and marketers; and (d) the local taxing of a product as it moves from one point in the market chain to another.

Figure 1

Market Routes For Poultry Products

Key:

Major trunk routes
Minor trunk routes
Area feeder routes

Figure 2

Commercial Poultry Facilities

Key:

H—Hatcheries and number
F—Feed mills and number

3. Major Impediments to Change/Progress

These have been outlined in Section B.2.b., and recommendations for action are given in Section C.

4. Priorities for Change

The UNDP/FAO Rural Development Program has built an infrastructure of facilities and staff that can be used to educate scavenger flock farmers in the technology of commercial poultry production. It also has the capacity to service commercial producers if the extension staff is upgraded and its responsibility expanded. In general, this program of rural development and the commercial industry are poised for expansion. The foundation of markets, hatcheries, feed mills, producers, labs and training facilities are available for growth. Recommendations for priority action are summarized in Section A and presented in Section C.

C. Project Analysis: Areas of Potential Program Emphasis

It has been recommended that a program to expand oilseed production in Pakistan be co-sponsored by a donor and the GOP because domestic production of edible oils and fats supplies only one-third of the annual consumption. With population increasing annually by two to three percent, the continued importation of oils and fats to satisfy human needs will become too great a burden on the nation's economy. Increased production of domestic edible oils and fats is critical to the economic health of the country.

Along with the need for oilseed production is the need to develop a market for the residues after the oil is extracted. Monogastric animals, such as poultry, have been a traditional market for these materials in other parts of the world. Therefore, any project to increase oilseed production should have a poultry development component.

Considering the constraints on development, priorities for action should be (1) training and development of sufficient, technically competent people to manage and service an expanding poultry industry; and (2) developing a research and development staff and facility that can provide a locally applicable technology for efficient poultry production and marketing.

1. Recommendations

a. Provide Technical Assistance to Train Field Staff for Teaching Husbandry and Management to the Various Segments of the Industry

This provision should be in two parts: (1) service personnel trained in Pakistan or abroad by poultry extension specialists; and (2) women trained to work in the villages to teach housewives flock management and vaccination and to recruit commercial producers. Such assistance should be carried out in cooperation with the existing provincial poultry development programs or private companies willing to participate.

(1) Fiscal

(a) Technical assistants to organize and conduct training of field staff: one male and one female.

- The male should be an expatriate with experience in poultry extension education. His function would be to organize an in-service education program to train Pakistani extension specialists. Training programs should include selection of district specialists for training abroad. This training should be practical rather than degree-oriented.

- The female should be a Pakistani with academic training equivalent to a B.S. in poultry management. If a Pakistani is not available, an expatriate woman would be appropriate. Her function would be to organize a training program for female poultry specialists to teach poultry husbandry at the village level.

- One of the technical assistants should have the ability to administer this program area.

- Funds for sending Pakistani trainees abroad for practical training should be administered through a land grant institution with experience and industry resources to give the trainees hands-on experience in small flock husbandry.

(b) Funds for Equipment, Teaching Materials and Travel

- Training centers will need visual aid materials and equipment, demonstration materials and specimens and practical experience facilities such as teaching flocks.

- Technical assistants, specialists and agents must get the villages to transfer knowledge to farmers. Travel funds for vehicles, their operation and maintenance should be made available.

b. Provide Technical and Financial Assistance for Research in the Existing Institutions Doing Poultry Investigations

(1) Fiscal

(a) A technical assistant to organize a program of research support. This person should have had experience equivalent to a director or assistant director of a land grant experiment station. His responsibility would be to counsel Pakistani research organizations on research priorities, set criteria, recruit applicants for research grants and organize a program of professional development for poultry and oilseed research.

(b) Funds for competitive research grants. These grants would go to researchers in poultry and oilseeds to stimulate development of production and marketing technology. Among other things, they should provide for salaries, operating funds, equipment, specialized facilities and support staff. The technical assistant would have to develop a system for administration and evaluation of the grants consistent with local procedures.

(c) Funds for short-term study abroad for principle investigators (PIs). There is a need to update some PIs in new techniques and research philosophies. The program should provide a means to do this. Funds should provide for study at a specific research lab and not for tours or post-doctorate study.

(d) Funds for graduate fellowship to train new faculty. There is a need for more research staff. This program should provide funds for graduate students to gain advanced degrees in poultry science.

(e) Funds for post-doctorate study and professional development for junior faculty. Just as senior staff need updating, junior investigators need improvement. Funds should provide for further study and seed money for beginning research programs.

(f) Funds for recruiting and training research support staff. Many labs visited had difficulty in getting and retaining technical staff. Also, there were problems with training the staff to operate new equipment. There should be funds to train these people and to help attract them to work

in research labs. The technical assistant would need to work with local agencies for this funding.

(g) Funds for special equipment and facilities identified by research institutions. For example, amino acid analyzers and sophisticated spectrophotometers for nutrition research and housing and monitoring equipment for hot weather management studies.

c. Provide Technical Assistance to Establish Industry Feed-Testing Laboratories

In this case, a person with experience in the organization and operation of an independent or state feed lab should be brought in to lead this effort. Labs should be set up at least in Sind and Punjab Provinces.

(1) Fiscal

(a) A technical assistant to organize and set up a feed-testing program. There should also be a Pakistani counterpart for this program. The feed industry needs access to rapid testing of ingredients to formulate rations properly. These should be easily accessible and independent of regulatory functions. This person would need experience in the operation and funding of this kind of service. Also, he would assist in establishing regulatory and research labs. It would be helpful if he had the ability to organize feed conferences for industry and institutional people. His purpose would be to convey current findings, review regulatory needs and establish market nutrient requirements.

(b) Funds for lab equipment, facilities and supplies. At present, there are no independent feed labs in the country. Funds are needed for buildings and equipment for protein, fat, metabolizable energy, amino acid, fiber, mineral and vitamin analyses. For a time, funds for reagents and expendable supplies would be needed.

(c) Funds for travel. The technical assistant would need to travel to supervise the program. Also, there may be the need for Pakistani counterparts to visit labs abroad for first-hand experience in their operation.

d. Provide Technical Assistance to Industry for Marketing

Bring in a consumer education-marketing specialist with experience in industry trade and promotional associations. This person should work closely with the Pakistan Poultry Association.

(1) Fiscal

(a) A technical assistant to set up a marketing and consumer education program. This person would counsel and assist in strengthening the marketing and promotional functions of the various poultry associations in Pakistan. He would cooperate with government agencies involved in nutrition education and agriculture marketing. The objective would be to smooth the flow of products through the market so production cycles take advantage of normal biological cycles.

(b) Funds for equipment, training materials, supplies and travel. As the program progresses, the technical assistant will generate promotional materials, training sessions and conferences. These will need financial resources for visual aids and travel.

D. Evaluation Plan

Evaluation would be a comparison of "then and now" statistics on volume of production, numbers of producers and efficiencies of production.

E. Policy Commentary

1. Government of Pakistan Perspectives

It is important that present policies for stimulating poultry production be continued. Feed quality could be improved quickly if policies were expanded to lift the tariffs on soybean meal. If comments received regarding local taxing practices are accurate, some changes to help smooth the flow of poultry products from surplus to deficit markets would be helpful. This would contribute to the maintenance of profitability and reasonable consumer prices. Reported price control practices also had a disruptive influence on industry profitability. Closer coordination with industry in setting prices would have a stabilizing effect on the market.

Of greater concern, however, is the matter of domestic supplies of food energy to feed both a growing human and animal population. Current supplies are adequate, but the future is questionable. Based on 1982 projections, the poultry industry will need a minimum of 391 thousand metric tons of feedgrains per year by 1985 (Table 6). As the commercial poultry industry and population grow, the competition for grain will increase. For both to increase, there must be a corresponding increase in feedgrain production. Because of this apparent limitation, Desi birds will probably constitute at least one-quarter to one-third of the

national poultry flock for the next five to ten years.

Table 6

Projected Poultry Feed Need for 1982
(Metric Tons)

	Protein	Energy	Total	--1982--- Feed Mill Capacity
Broilers	51,500	112,000	163,500	
Layers	129,000	279,000	408,000	
TOTAL	180,500	391,000	571,500	355,000

Source: See Robert E. Cook, "Commercial Poultry Production," in Part VI of this series.

2. Donor Country Perspectives

It is doubtful that expansion of poultry production in Pakistan would adversely affect a donor country. Most likely, it would have a beneficial effect on Pakistan's trade with these countries. A strong poultry industry would strengthen the local economy, contributing to Pakistan's ability to trade more equitably with its neighbors.

A PROGRAM FOR IMPROVING LIVESTOCK PRODUCTIVITY OF MEAT AND WOOL

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A. Detailed Description

1. Background

Consideration by donor countries of initiating a program for increasing the production of edible oil in Pakistan was prompted by a recognition of the high and increasing cost of importing these oils. Since increasing oilseed production would ultimately result in an increased supply of by-products for animal feeds, this assessment of the associated effects of the primary thrust (edible oil production) on the livestock sector was deemed useful. This effect must be considered in the context of the total livestock sector situation since oilseed by-product feeds are only one component of production inputs.

There can be little doubt that Pakistanis consume a low level of animal protein; according to the 1980 FAO Production Yearbook, per capita consumption per day for 1977-79 was 13.5 grams. The comparable value for Syria, a country with many cultural similarities, is 17.8 grams. Total protein intake amounted to 59.0 grams and 75.5 grams for Syria and Pakistan, respectively. The plight of rural people appears even more critical from the World Bank Report No. P-1860-Pak which indicates this subgroup consumes only 4.9 kg of meat yearly and 50 grams of protein per day.

Sheep and goats are the most numerous species of livestock, with 1980-81 data showing the national population at 28.5 and 32.8 million, respectively (Table 1). The populations could also be expressed as 4.3 and 4.9 million animal units, respectively. These numbers have been increasing rapidly since 1945 at an annual rate of over nine percent. This reflects, in part, the great popularity of mutton and the increased emphasis in some areas of the prolific Bengal goat. By contrast, the total number of cattle and buffaloes are estimated at 15 and 11 million, respectively.

Table 1

Sheep and Goat Population in Pakistan
(Millions)

	1945	1955	1960	1972	1976	1978	1980
Sheep	7.3	8.1	12.3	13.5	18.9	20.5	26.2
Goats	7.3	7.4	10.0	15.8	21.7	23.6	30.2

Source: M. Siddiqi, M. Akram Qazi and Usman Haider, Sheep and Goat Production in Pakistan. University of Faisalabad, 1981.

The ownership distribution of sheep and goats is important. Probably more than 12 million households own sheep and goats. Obviously, most of these households have only a few animals, and only 4.2 and 1.4 percent of reporting households own more than 50 sheep and 50 goats, respectively. To further complicate the picture, most of these owners are landless. With few exceptions, feed for the animals is restricted to gleaning harvested fields and orchards, grazing roadsides and other uncultivated land in population areas, and grazing the sparse forage available on badly over-grazed mountain areas. Thus, improvements in efficiency of sheep and goat production will have to take place in an environment of small flocks, with little control over their feed resources and little knowledge of breeding, management and nutritional alternatives.

Sheep and goat flock owners in Baluchistan present some unique problems. These owners can be described as migrants or transhumants, traveling as much as 500 miles twice yearly, following the weather and plant growth patterns from north to south and returning. The winter months are spent in lower elevations of southern Baluchistan or adjacent Sind Province where flocks graze on crop stubble and owners find day work on farms or construction labor. In summer, they return to the north and higher elevations where their flocks graze common or tribal areas.

Grazing pressures are so great that only the least palatable fibrous plants survive. Slopes are eroding and animals survive at very low levels of production as measured by lambing rates (70 percent), growth rates and mature size. Despite these problems, owners emphasize animal numbers, exacerbating the problem. Goats are viewed as better able to survive these conditions, but in time, they will further denude the ranges if stocking rates are not controlled. A similar situation exists in the Northwest Frontier Province, particularly in the north. There, livestock of both transhumant and local landowners compete for grazing.

The cumulative contributions of products, especially meat from sheep and goats, is impressive (Table 2). Milk produced in 1980-81 from sheep and goats amounted to 39,000 and 441,000 tons, respectively (Table 3). However, this milk has little commercial importance since most of it is consumed at home. Meat from sheep and goats totaled 185,000 and 248,000 tons, respectively. Overall, the contribution from goats is predominant. Table 3 shows the average carcass weight of sheep and goats is low (12 and 11 kg) by most standards and has been essentially constant for the last 10 years. There has been no particular emphasis on breeding for greater size. Feeding out of weaned animals before slaughter is as yet little practiced.

There are at least nine recognized breeds of fat-tailed sheep, with averge mature sizes ranging from about 24 to 37 kg. Of the nine breeds of thin-tailed sheep, most have average mature sizes in the 25 to 40 kg range, but one breed, Thalli, has a typical mature weight of 18 to 22 kg. Four breeds of milk goats and 11 breeds of meat goats show a great diversity of size--20 to 65 kg.

Goat milk is a minor item for commerce since most of it is consumed in some form by the owner's family. The primary commercial potential for sheep and goats appears to be as meat producers, with wool as an important secondary product.

Table 2

Production Contribution of Sheep and Goats, 1980

Commodity	---Unit---	Sheep	Goats	Total
Meat	000 Ton	171	288	399
Milk	000 Ton	36	406	442
Skin	Million Ton	13.8	17.9	31.7
Hair	000 Ton		5.7	5.7
Wool	000 Ton	42.6		42.6

Source: M. Siddiqi, M. Akram Qazi and Usman Haider, *op. cit.*

Table 3

Carcass Weights Per Animal Slaughtered
(Kg)

Class	1969-71	1979	1980	1981
Beef and Veal	114	113	112	113
Buffalo	82	82	82	82
Sheep and Lamb	12	12	12	12
Goat	11	11	11	11

Source: FAO Production Yearbook, Vol. 35, 1981.

Cattle are the third most numerous livestock species with about 15 million head (Table 4) and contribute over 186,000 tons of meat yearly (Table 5). It is important to note that most adult cows are kept for milk production and adult males are mostly kept for draft. Thus, a good share of the beef from cattle comes from cull cows or worn-out work bullocks. Such animals usually are slaughtered as soon as culled, with no intervening fattening period.

Table 4

Livestock Population of Pakistan
(Millions)

Species	1972-73	1973-74	1974-75	1975-76	1976-77	1979-80	1980-81
Sheep	14.8	16.1	17.5	18.9	20.5	26.2	28.5
Goats	17.0	18.4	20.0	21.7	23.5	30.2	32.8
Cattle	14.7	14.8	14.8	14.8	14.9	15.0	15.1
Buffalo	10.0	10.2	10.4	10.6	10.8	11.5	11.8

Source: Agricultural Statistics of Pakistan, 1981.

Table 5

Production from Livestock, 1980-81

Commodity	---Unit---	Sheep	Goats	Cattle	Buffalo
Meat	000 Ton	185	248	186	198
Milk*	000 Ton	39	441	1,577	5,215
Skin	Million Pieces	14.97	19.44	1.91	2.93
Hair	000 Ton		6.15		
Wool	000 Ton	46.22			

*Milk available for humans.

Source: Agricultural Statistics of Pakistan, 1981.

To feed out culled and worn-out animals is not considered profitable because of the low price of beef--about Rs 4.5 per kg live weight--and the lack of market recognition of meat quality differences. Beef is considered the poor man's meat, and most of the production and marketing circumstances seem to be conspiring to perpetuate this condition. The average slaughtered carcass weights reported of 187 kg for oxen and 108 kg for cows attest to the poor condition of the animals.

Buffaloes are kept almost exclusively for milk production. The cows are prized for their milk of high fat content and their perceived ability to survive and produce in a harsh environment with low-quality feeds. Among 11.8 million buffalo (Table 4), approximately 57 percent are females of three years or older, 26 percent females of less than three years, 2 percent males of three years and older and 15 percent males of less than three years. These sex-age relationships are evidence of the commonly-

held belief that male buffaloes are primarily a necessary cost of keeping cows in milk.

The small, average slaughter weight of 82 kg (Table 3) indicates many animals are slaughtered as calves with little effort or interest in growing them out. It is estimated that 1.1 to 1.25 million male buffalo calves are either slaughtered at a very young age (1-2 weeks) or are fed only enough to survive for seven to eight months. They are used to stimulate milk let-down of their dams and then are slaughtered. In both cases, the potential for rapid, efficient growth in young animals is not being exploited.

The unfavorable meat price to feed cost relationship that depresses meat production from cattle is also pertinent to the feasibility of feeding out young male buffalo. Either a low cost, unconventional feed source or a considerable increase in beef prices is required to make such an enterprise attractive.

Some data on the distribution of cattle and buffaloes is presented in Table 6. Two important relationships appear in these data: (1) about three-fourths of the cattle and buffaloes are in herds of six animals or less; and (2) more than 90 percent of the households owning cattle or buffaloes own six or fewer animals. Therefore, any production improvement program aimed at benefiting a majority of cattle, buffaloes or households owning those animals should be targeted toward herds of less than seven animals.

Table 6

Distribution of Buffalo and Cattle by Herd Size and Number (1,000)

	Buffalo		Cattle	
Herd Size	Households Reporting	Numbers of Buffalo	Households Reporting	Numbers of Cattle
1 - 2	1,894,314	3,047	1,981,280	3,332
3 - 4	977,262	3,323	1,173,758	4,101
5 - 6	332,720	1,797	534,395	2,895
7 - 10	170,763	1,368	287,140	2,298
11 - 15	40,803	508	62,157	7,692
16 - 20	10,730	189	14,842	261
21 - 30	5,297	129	7,749	189
31 - 50	1,969	74	2,623	100
Over 50	927	100	1,004	149
TOTAL	3,434,785	10,534	4,064,947	14,093

Source: Pakistan Census of Livestock, 1976.

The feed resources of Pakistan are very low in relation to the present livestock numbers. In a paper presented at the 28th Pakistan Science Conference in 1982, Mohammad Yaqoob Malik compared estimates of total national feed resources to maintenance requirements of all livestock. These estimates indicated a deficiency of 64 percent in total digestive nutrients (TDN) simply for maintenance. While it is questionable that the actual shortfall is of this magnitude, the comparison emphasizes that a major imbalance exists and that it must be corrected if any noticeable progress is to be made in production per animal. Either a reduction in numbers or an increase in TDN amounts fed will improve the situation. Given the traditional prestige associated with high animal numbers, any attempt to reduce flock or herd size will be resisted. A more immediately feasible but limited opportunity lies in better utilization of existing feed resources, increasing feeding value through treatment and increasing yields of forage crops.

Improved utilization of crop residues, by-products and animal wastes is a distinctly possible route to an early increase in meat production. Estimates of the amounts of these materials are presented in Table 7. Most crop residues are probably already being used in some way, but the feeding values of some could be increased by 25 percent, i.e., from 35 to 45 percent TDN, by treating them with alkali, urea, anhydrous ammonia or steam. The opportunity for increased use of molasses could not be determined. It is generally recognized as a low cost energy feed.

Table 7

Crop Residues and Livestock Wastes Produced in Pakistan (Million Ton)

Material	Production D.M.	Production Ton
1. Crop Residues	31.73	15.07
Cereals	18.36	8.66
Sugarcane	7.88	4.01
Sugar Beets	0.14	0.09
Legumes	1.43	0.76
Cotton	3.30	1.36
Rape and Mustard	0.62	0.19
2. Molasses	0.38	0.36
3. Livestock Wastes	3.03	1.27
Buffalo/Cattle Fecal Wastes	2.93	1.23
Poultry Fecal Wastes	0.10	0.04
TOTAL	35.14	16.70

Source: "Coordinated National Programme for Livestock and Dairy Development," AG:DP/PAK/74/018, Terminal Report, 1980.

Transportation, distribution and storage are major problems limiting molasses use by small and landless farmers. One sugar mill owner complained of having to store molasses or dump it due to a weak market. Livestock wastes, especially, are not fully utilized. Where available, poultry droppings or litter could constitute 25 to 30 percent of a good fattening ration with inexpensive treatment and mixing methods. This markedly reduces or even eliminates the requirement for high protein ingredients such as oilseed meals in such rations.

Oilseed crop by-products have an important place in traditional livestock husbandry although they are used for non-milking and non-working stock, usually as a last resort until they can survive on available roughage. The most commonly used by-product is cottonseed cake, followed by rape and mustard seed cake. This is a reflection of relative importance of various oilseed crops. Seed production in 1,000 tons for 1980-81 is given as rape and mustard, 252.5; groundnut, 57.3; sesamum, 18.3; soybean, 1.23; and sunflower, 1.94 in the Agricultural Statistics of Pakistan, 1981. The comparable value for cottonseed was calculated at 1,429 (production of cotton lint x 2).

Expeller mills are the predominant method of processing, with more than 400 small mills (7-60 tons/day) and about 19 large ones (100 tons/day). These mills accounted for about 80 percent of oil production in 1973/74, while solvent extraction plants produced about 11 percent. The remainder is produced by thousands of village crushers (kohlus).

Oilseed cake is the major by-product since expeller mills and crushers are used on most of the oilseeds. Cake is preferred over meal from solvent mills by farmers as a livestock supplemental feed. Their preference is probably well-founded because the cake, containing six to nine percent oil, is higher in digestible energy, although lower in protein content. Under present conditions, available energy is often the first limiting nutrient component for optimum weight gain. Ease of handling and feeding cake as opposed to meal also may be a factor in the preference. Meals are more suitable for a mixed feed industry which is almost nonexistent for most livestock.

One might question why the use of expellers continues in view of their relative inefficiency and the recognized need for oil. Most of the answer seems to lie in the location and ownership of the mills. Many expellers are adjacent to a cotton gin and may be owned by the same person(s). The expeller can handle seed that has not been well delinted. This makes ginning easier. Investment in expellers is returning a profit, but changing to a solvent mill would require new investment and discarding of old equipment. The owner would also have the problem of selling a by-product (meal) not as popular with farmers.

From a nutritional point of view, either by-product is useful to livestock and one can hardly justify inefficient extraction on

the basis of providing edible oil to livestock. Solving the problem of inefficient extraction appears to be the obvious first step toward increasing the edible oil supply.

2. Current Status

a. Strengths

(1) The national livestock population is fairly large in relation to the human population. There is about one sheep per 3.4 people; one goat per 3.0 people; one buffalo per 7.6 people; and in the cattle group (including work bullocks), about one per 9.7 people. This means that even modest gains in per animal productivity will be of major significance in terms of availability per capita. It also means that rather heavy culling is feasible without seriously depleting the supply of breeding stock.

(2) There is a large potential market for meat. The Pakistani population would eagerly consume much more meat if it were within their means. In addition to domestic demand, there is a large market in neighboring Mulsim countries, especially in the Gulf states. This export market offers prices severalfold higher than domestically prevalent.

(3) The labor force is large and works at low wages. Thus, improved management and feeding systems may be implemented with moderate capital inputs by utilizing labor for such items as cleaning, feeding, mixing rations and manure handling.

(4) Livestock officials at both the federal and provincial levels appear genuinely interested in improving livestock production, even though their ability to implement that interest has been affected by numerous factors.

(5) Large amounts of by-products are generated from the processing of grain and sugar crops.

b. Weaknesses

(1) Animal numbers in all species and in nearly every situation are much too high in relation to the quantity and quality of food supplies. The concept that fewer, more productive better fed animals will result in more net production at a lowe cost appears to be unknown or at least unaccepted. The acceptance and implementation of this concept is absolutely essential to any general, long-term increase in national output of animal products.

Emphasis on retaining a maximum number of animals is, in part, based on the meager resources and uncertain existence of the owners. Extra numbers are viewed as insurance against an unusual

event or calamity. Unusual family expenses may be met by selling some surplus animals. If disease kills many of his animals, the owner has more assurance that he will have some survivors with which to make a new start.

(2) Feed supplies are inadequate in both quantity and quality. This is related to the traditional emphasis placed on animal numbers and the fact that most flock owners do not have direct control over lands used for grazing. This shortage of feed is particularly acute for the migratory owners whose animals "graze" barren tribal areas in competition with other flocks whose owners are also placing emphasis on numbers of animals. The net result is nearly denuded ranges where the most palatable and nutritious plant species have been eliminated.

No doubt, the shift to more goats in such areas has been prompted by the goats' greater ability to survive under such conditions by eating higher tree branches and poor quality shrubs, and by climbing into less accessible areas. It appears to be only a matter of time until even the ability of goats to survive will be reduced under the present system. The plight of non-migratory owners is not much better since they are competing for the grass brush and trees on roadsides, ditch banks, public areas and crop residues.

Supplemental feeding of purchased feeds, except for milking cattle and buffaloes, is usually a last resort when animal survival is clearly threatened. The low productivity of animals, current product prices in relation to feed costs and the small financial resources of owners make feed purchases extremely unattractive.

(3) Education and training in livestock management and nutrition, and in management of forage and range resources is essentially nonexistent. This results from a deficiency of extension staff and resources in the appropriate disciplines and from difficulties in effectively communicating with rural people. Rural people are mostly illiterate and live in remote areas or villages without the amenities demanded by a professional staff.

(4) Among most flock owners there is no consistent breeding system nor selection for size, growth rate or lambing percentage. On the contrary, emphasis is placed on the number of animals and their ability to survive under conditions of poor nutrition and inadequate and/or sporadic feed supplies.

(5) Veterinary treatment, especially in prophylactic vaccination against contagious diseases, and control of worm infestations is inadequate. This is true despite the major emphasis of extension services on veterinary activities. Nearly every area is under the jurisdiction of a veterinary clinic or field service veterinarian. However, flock or herd owners are often not concerned about animal health until animals are visibly sick, barren or dead. Thus, veterinary assistance is not requested except for emergencies, and routine health maintenance

procedures are not followed.

(6) Marketing fleeces and animals is not organized in a way that is favorable to flock owners. Typically, fleeces and animals are offered by owners on an irregular basis and in small numbers. Thus, they do not attract the interest of primary users, but generally sell on a one-to-one basis with middlemen buyers. The producer has little bargaining power under such an arrangement and practically must accept the price offered. Some migratory owners are in an especially difficult position since they are often far removed from consumption centers, do a poor job of clipping and preparing fleeces and sell females only as a last resort.

(7) The government policy of keeping beef prices low makes fattening of salvage cows, bullocks or buffaloes generally unprofitable. Thus, beef is usually of poor quality and not relished by consumers. A free market could offer better cuts and quality to more affluent consumers at higher prices and still provide lower quality cuts to low income consumers.

3. Major Impediments to Change/Progress

The major impediments to progress have been strongly implied in the above explanations of weaknesses. However, some further clarification may be helpful. The pattern of land ownership is a basic problem to maximizing the long-run productivity of land and/or animals. Owners who share grazing rights with others, either on tribal or public land, have a tendency to apply as many animals to this "free" grazing as possible, to harvest as much as possible for one's self before someone else's animal grazes it. This amounts to powerful incentive to over-graze, eventually destroying the more palatable, nutritious species and leaving only those less desirable. This reduces available grazing for everyone.

Goats have a special place under these conditions since they are better foragers than sheep. In the long run, goats seem to be outstanding for their ability to completely destroy the range ecosystem, although at present they are better able to survive and produce under deteriorating range conditions.

Many owners lack knowledge regarding fundamentals of animal management and nutrition, which is a major obstacle to establishing improved practices. These people must be reached by very personal, oral contacts through a person whom they have learned to trust by experience and observation of demonstrations.

Government policies on meat prices in the domestic market and restrictions on meat exports result in such narrow meat/feed price ratios that profitable use of conventional feeds for fattening is nearly a biological impossibility. Home production of low cost feeds is often not a viable option to this cost/price squeeze in view of relatively high price guarantees for major

cash crops such as rice, wheat and sugar.

Limited arable land and water resources as related to human population is a difficult reality to overcome. Thus, the expansion of conventional animal feed production (quality forages and grains) is restricted. Even if added land and water become available, the pressure to use it for high-value crops for direct human consumption or export probably would be paramount. If, however, additional land is brought into production that is not well-suited for cash crop production because of soil, water, topography or location, development of a forage-based animal production industry is distinctly feasible and might be favored by national planners.

4. Assessment of Priorities for Change

Unfortunately, the item of highest priority--reducing animal numbers to be consistent with feed supplies--is the most difficult change to achieve. Therefore, a different order of priorities is presented in the hope that when owners see the advantages of higher production levels, they will voluntarily move toward reduced animal numbers.

An effective extension service program for advising and educating farmers is probably of the next highest priority. Basic changes in production practices are unlikely without the voluntary participation of the people most affected. This cannot take place until they understand and accept the objectives and approaches of new programs. This admittedly is a very difficult task and one that has already received much attention. Vested interests in the present organization of extension and lack of appropriately trained professionals are obstacles to be overcome.

Changes in the availability of high quality supplemental feeds at a reasonable price must also occupy a place of high priority. Without these changes, no improvement in animal productivity nor relief of over-grazing can be expected. The harsh reality for the owners is that in the short run, they may have no choice but to depend almost exclusively on very low cost or free fodder, given the low productivity of their animals and the depressed markets for their products.

Reduced stocking rates and establishment of a controlled range management system for grazing lands in the mountainous tribal areas must realistically occupy a position of lower priority. Grazing rights have been held by tribal and migrant people for centuries and cannot readily be controlled nor regulated by the passing of regulations by government bodies. It is only through education and demonstration that these people can be made to see it is in their own best interest to reverse the destruction of their most valuable resource. In the long run, renewal of ranges and forests may be of greatest importance to Pakistan since present trends are contributing to flooding, poor water quality and seasonal water shortages, leading to eventual destruction of

grazing and forest resources.

B. Project Analysis

1. Technical Description

The proposed project consists of simultaneous advancement in two interrelated activities. One is the development of a new and more comprehensive segment of extension personnel devoted to advising and training farmers in all aspects of livestock enterprise. The second is the formation and support of livestock associations (LAs) focused around feed-out lots strategically located to make maximum use of wastes and by-products.

a. Enterprise-Oriented Extension Services

There is a deficiency of trained, motivated extension professionals in all agricultural fields. Any attempt to overcome this national deficiency through one huge extension-strengthening program, although well-intended, invites failure because of its scope and dimensions. Alternatively, it is proposed to establish, train and support a small but strong comprehensive extension service, responsible to a limited clientele--namely, the members of LAs. The purpose, formation and function of LAs are described in Section B.1.b. These extension specialists should not be integrated into the existing Livestock Extension staff, but set up as special livestock production teams reporting directly to the Provincial Director of Livestock Production, Extension and Artificial Insemination, or his equivalent.

Such an organizational approach would have two primary advantages:

1. It avoids becoming involved with the long-running debate of whether a more responsible livestock extension service should be implemented through veterinarians additionally trained in management, nutrition, agronomy, breeding and marketing or personnel specifically and more thoroughly trained in these various disciplines. The present Provincial Livestock Extension organizations are largely devoted to providing veterinary services with staff training oriented toward veterinary subjects. It would be difficult to achieve proper emphasis on non-veterinary areas within the existing organizational framework.

2. It creates a situation in which extension personnel can identify with a restricted clientele--the LA members. In large measure, the success of the staff is keyed to

the progress of members. This is an important distinction from the existing system in which professionals are assigned to such a large and diverse clientele that progress or lack of it may be difficult to perceive.

The locations, size and number of LA centers are, of course, the primary determinants of servicing extension staff requirements. As a general model, it is recommended that the disciplines of farm management economics, animal hubsbandry, nutrition, range management, forage agronomy, marketing and veterinary science each be represented by one expatriate advisor. Each advisor would be assigned to four LAs, or about a quarter of the time at each LA feed-out center and in membership development.

It is recommended that two Bachelor of Science graduate counterparts be assigned to each expatriate at each center. This would provide for continual counterpart presence while allowing for graduate training of one of the counterparts on an alternating basis. The third component of staff should be two technical assistants for each subject area at each center. This number is intentionally low to ensure frequent personal participation of all professionals in the daily activities of the feed-out center and the field.

Advisory and Teaching Staff for One Livestock Association

	Number		
Discipline	Expatriates	Counterparts	Technicians
Farm Management Economist	.25	2	2
Animal Husbandry	.25	2	2
Nutrition	.25	2	2
Range Management	.25	2	2
Forage Agronomy	.25	2	2
Marketing	.25	2	2
Veterinary Science	.25	2	2
Project Manager	.25	1	2

Extension activities can best be implemented with inactive farmers where repeated, appropriately timed contacts can be scheduled. Instruction in such subjects as maintaining animal health, breeding systems, animal selection, optimum stocking rates, relationships of growth rate and feed efficiency, relative value of various purchased feeds, shearing techniques and marketing options should be of interest and helpful to even landless flock owners. The possibilities for a farmer audience which

controls some land resources are even greater. Subjects for this group could also profitably include forage crop production, improved crop varieties, fertilization, crop rotations, test plot demonstrations, sequential planting, rotational grazing, forage preservation systems and maximizing farm income. Farmers who can be effectively reached by such a program will become more prosperous and more valuable to the country, regardless of what pricing and control policies are followed nationally.

Extension approaches that will effectively reach migrant owners will be more difficult to devise. Since they have little control over feed availability, the program should emphasize advantages of healthy animals, early identification and culling of unprofitable animals, planned breeding schedules, shearing techniques, marketing alternatives, range management techniques of docking, drenching and vaccinating and advantages of early weaning and feeding out.

There is a real danger that the farmer's response to a ready market for early weaned animals, participation in feedlot profits and the availability of additional feed will be to add more breeding females. He may reason that he could profit beyond these advantages by enlarging his herd or flock. Since the basic national problem is too many animals existing at low levels of production on a relatively inadequate feed resource, such a response would be counterproductive from the viewpoint of both the nation and livestock owners. Therefore, some means of preventing such a reaction should be an integral part of the total program of the LAs.

An economic incentive for livestock owners to reduce numbers is recommended since owners will initially be unconvinced that fewer but more productive animals are in their own interest. For example, a present flock owner in an area might be marketing only 80 lambs from a flock of 100 ewes. One might reasonably expect that he could still market 80 lambs from a reduced 80 ewe flock, provided the 80 remaining ewes could benefit from greater feed availability and better care and management. He could be offered a guaranteed return for his lambs for five years in return for culling 20 ewes from his flock and maintaining the reduced size for five years. His immediate bonus would be the sale price for 20 cull ewes.

Agreement of all owners using a specified feed resource (i.e., tribal land, common area or individual landowner) would be needed for such a system to work. It is critical that as soon as the flock is reduced, the extension staff work closely with the owner in supervising the care, management and breeding of his flock so the increase in lambing and off-take does, in fact, occur.

The great difficulty facing a program of herd/flock size reduction is recognized. However, some quick method of bringing the requirements and availability of feed into alignment must be found for at least some limited segments; otherwise, all the effort toward greater feed production and use of waste and by-

products will have little net effect on efficiency. Pakistan has been attempting to improve productivity in livestock through attention to the feed supply for many years, but with only minor success. Clearly, a dramatic reduction in animal numbers must be achieved to break the vicious cycle. Pakistani counterparts could best propose an effective approach since they have a better understanding of traditional values and motivations.

It is recommended that all counterpart professionals be given the opportunity for advanced training in their specialities. Training programs should emphasize study and experience in applying knowledge. Only secondary importance should be accorded advanced degrees. In addition to formal instruction, each trainee should receive about six months' training at an institute abroad. This hands-on experience in livestock farm skills is considered an important element for effective communication with LA members.

b. Livestock Association Feed-Out Lot (LAFL)

Four LAFLs will be distributed as follows: one in each province to a sugar mill or other source of waste. Each LAFL will function as a service unit for the LA members by feeding out and marketing their excess animals. It also will serve as a focal point for farmer training and education activities and for distribution of production supplies to members. Each LAFL will be designed to handle 1,000 sheep/goats or 200 feeder calves.

Rations will emphasize the use of agricultural wastes and by-products, i.e., bagasse and/or straw treated with steam alkali and/or urea, molasses, poultry litter, milling by-products, oil-seed cakes or meals and any other locally available by-product. Ration ingredients will be purchased, stored, treated and mixed by the LA at the feed-out facility. Additional mixed ration and other production inputs will be available to members at cost, to the extent feasible. A ration mixing facility will be needed at feed-out locations, storage bins and silos.

Prospective farmer members will be attracted by the opportunity to sell animals at the full prevailing market rate at the time of sale, plus a supplemental payment based on a proportion of the profit realized from feeding out their animals. Members will be entitled to educational services and to the benefits of any group, purchasing or selling, that may develop.

Available data and recommendations from the Pakistan Agriculture Research Council indicate that rations based on wastes and by-products will provide a rather comfortable ratio between feed costs and the gain value of sheep and goats on the local market. An additional positive factor is the present provision that 50 percent of the output of intensive feeding operations may be exported to neighboring Muslim countries where prices are much higher, especially for mutton and goat meat.

2. Social Benefits and Constraints

The project should result in higher levels of education and income for livestock owners. Perhaps as important will be a feeling of accomplishment, higher self-image and experience in cooperating for a common objective. Although the number of farmers initially benefited will be relatively small, the good news will spread very quickly if success is real and livestock is seen as a profitable enterprise.

Constraints will probably be in the area of owners' reluctance to participate closely as actors rather than observers in a government-sponsored activity. The traditional view that small landowners or landless farmers are victims of their fate is probably strongly held by the victims themselves. Overcoming this obstacle depends very much on building trust through demonstrations of successful techniques. Some resistance from agents and middlemen buying from farmers and selling to butchers and dealers can be expected.

3. Economic Effect

The economic effect on an individual owner is difficult to quantify. Substantial, positive effects should accrue from (i) an assured fair price for the animals sold; (ii) shared profits from feed-out operations; (iii) higher prices for wool/hair; (iv) improved productivity of breeding flock resulting from better breeding; and (v) reduced numbers and higher productivity of ranges or forage crops. As LAFLs develop their capacity to process by-product rations above the needs of feedlots, members will have access to such rations for breeding flocks or, alternatively, may be instructed on how to prepare their own.

Present government policy is to allow half the output of a feedlot to be exported. This policy encourages feedlot development and yields foreign exchange. It will not, however, yield more meat for Pakistan unless animals more than double their weight in the feedlot. The domestic beef price is expected to increase when price controls are relaxed in the near future. The immediate effect on lamb prices probably will be small. Feeding margins for beef are so narrow now that profits are questionable. However, if the price for beef is set free and producers begin to improve quality, a profitable beef feeding operation is possible. If this occurs, a very large increase in beef supplies could result from feeding out a fraction of the available male buffalo calves, cull cows and bullocks.

4. Environmental Effect

The major effect will be a regeneration of denuded ranges in watersheds from reduced grazing pressure. An increase

in water infiltration, reduced erosion, cleaner river water and reduced flooding can be expected. Through proper management, the ranges can support more animal production while reducing the damage from erosion and flooding. Although not as marked, improved soil structure and water control will result from intercropping of forages in orchards and from including forage crops in the rotation. Improved ground cover on public lands will result from controlled grazing. With normal care in the selection of LAFL sites, environmental contamination from manure accumulations should be minimal. Demand for manure is so high there should be no problem in getting it returned to fields and orchards.

5. Administrative Feasibility

Administering the project will be somewhat difficult, primarily because it will function outside the established Pakistani extension and government farm system by forming producer associations and nearly autonomous LA centers. This will nearly reverse the producer/service personnel relationship. Presently, service personnel make most of the decisions as to what, where and when services will be provided to producers. However, when the LAs become fully functional, producers will decide what service program is required and how it will be paid. The existing extension services for livestock are largely veterinary and all government offices concerned with livestock in any way are staffed primarily by people with veterinary training. Any deviation from the existing organization will be seen as a threat by some and therefore resisted.

Small farmers are highly individualistic and not accustomed to cooperating and/or sharing for the greater good of all. Thus, a very good system of monitoring and controlling materials, money and facilities will be required to prevent waste and abuse. Hopefully, when LA members take a more proprietary view of the LA this problem will be reduced.

The success of LAs will depend greatly on obtaining well-qualified and adaptable expatriate consultants on a continuing basis. Long-term assignment of consultants to the project would be most desirable if reasonable living conditions can be arranged. If not, a planned series of personnel on temporary duty (TDY) may be more realistic. In any event, continuity of the input of the same consultant is recommended.

It is crucial that the existing bureaucracies be convinced of the value of the project before its initiation. Only in this way will the necessary administrative cooperative be obtained to carry out the somewhat unconventional organizational character of the LAs. Their problem may be especially acute with regard to the proposed education-extension approaches. It is recommended that funds be allocated as directly as possible to individual LAs. The director of each LA should have authority to disburse funds and account for them through a yearly audit.

C. Evaluation Plan

Some effects of the project can be measured quite directly. Suggested direct measurements are (1) per head, live weight gained by animals fed in LA lots; (2) daily rate of gain in LA lots; (3) feed costs per unit of gain in LA lots; (4) live weight prices and fleece/hair prices received by LA members; (5) weight and quality of fleeces; (6) lambing percentages; (7) size of animals entering LA lots; (8) changes in amount and species of ground cover on the ranges; (9) carrying capacity of ranges; and (10) farm income.

Obtaining the necessary data for the above evaluation criteria depends on the cooperation of LA members. Therefore, one condition of LA membership must be a willingness to record and furnish appropriate supporting information. It is also important to establish reliable baseline values for all criteria so improvements may be readily calculated.

The indirect project effects cannot be as readily evaluated. Requests by non-LA members to join an existing association or to form additional LAs could be regarded as a measure of success. Similarly, growth in the membership's number of animals fed and progress toward financial independence are all indications of success.

Evaluation of environmental effects from improvement of ranges could possibly be measured as changes in stream water sediment content, gully formations and height of flood waters. Such evaluations, however, assume control over a major portion of a defined watershed.

A reduction in the number of breeding animals in member flocks while maintaining the same level of off-take might occur. In this case, it would be regarded as a positive effect.

D. Implementation Plan

An economic feasibility study should be conducted to determine the profitability of LA feed-out centers at proposed locations. The study would include gathering data on cost and availability of feed ingredients and feeder animals, market demand, prices for meat and wool and export costs as they apply to specific locations. A location along a major migratory route such as Sibi, Baluchistan, should be among those studied.

E. Fiscal Plan

The cost of implementing this project has been estimated on the basis of a total for four LA centers. Thus, adjustments can easily be made for more or fewer centers, depending on the availability of suitable sites and available funds. Estimates should be regarded as very rough and need verification and refinement before further project development. No inflation adjustment factor has been included since such an adjustment might well fall within the error of the estimate. Keep in mind that revolving operating funds for feedlot operation include funds for purchase or production of feed for six months. Assuming ninety-day feeding periods, receipts from the sale of animals should be sufficient to continually replenish the fund. Thus, the operating fund would be a one-time only project expense.

Estimated Budget for Four LA Centers
($U.S.)

	----$-----
Fixed Costs:	
1. Initial building and equipping of centers and feedings lots	$1,000,000
2. Revolving operating fund for feed lots:	
a. Purchase of animals at $28,000 x 4	112,000
b. 180-day feed supply (purchased and produced) at $28,000 x 4	112,000
c. Veterinary supplies at $800 x 4	3,200
	$227,200
Recurring Annual Costs:	
1. Personnel	
a. Expatriate advisors (11 years)	$2,000,000
b. Pakistan counterparts (32 years)	304,000
- Technicians (64 years)	307,000
- Machine operators (8 years)	19,200
- Stockmen (8 years)	16,000
- Clerk (4 years)	9,600
- Chowkidar (4 years)	6,400
- Cleaners (4 years)	6,400
	$2,668,600
Counterpart training (9 man-years)	$180,000
2. Supplies and operating	
a. Instructional materials	$20,000
b. Office supplies	2,000
c. Utilities	4,000
d. Automotive	20,000
e. Tractor	8,000
f. Miscellaneous	4,000
	$58,000

Determining which expenses will be borne by donor and host will be a matter for negotiation. However, it seems likely that Pakistan would at least accept responsibility for salaries of Pakistani employees. Land acquisition costs have been omitted from the plan since it is assumed that Pakistan would donate the sites, including about 100 acres of crop land for each. Careful consideration of existing facilities and equipment or the planned activities of other donors may reveal possibilities of multiple uses and associated budget savings.

F. Policy Commentary

The proposed project will utilize little oilseed meal or cake. In this sense, it does not constitute a strong component of a thrust to expand Pakistan's domestic edible oil production. Designing a project emphasizing the use of oilseed meals in ruminant rations does not seem economically justified because low available energy is generally more of a constraint on livestock productivity than protein deficiency. If one relieves the constraint of low energy by treating cellulosic materials or using high energy by-products (molasses and beet pulp) animals become better able to utilize non-protein nitrogen such as urea, and the demand on natural protein supplies is not increased. Any additional oilseed meal, especially soybean, would be more logically utilized by poultry where a low fiber, high natural protein feed ingredient is necessary. It is possible that some time in the future livestock productivity levels will be high enough to warrant the use of a high-quality, high-priced protein source such as oilseed meals.

Parts of the project involving use and/or control of tribal grazing lands will raise important political issues for Pakistan. Such innovations must be approached with caution and on the basis of voluntary cooperation of people holding traditional grazing rights. Voluntary cooperation could come about by direct leasing of certain ranges by the project from tribal groups to attain control of grazing management and range improvement. Alternatively, migratory owners may be convinced they can retain the same net off-take rates with smaller and better fed flocks by taking advantage of the opportunities offered by LA membership.

The policy issue of effects on existing extension services will be troublesome only if changes are seen as a threat to the security of important established groups. Hopefully, these groups will see the project as an opportunity to ultimately expand and improve the scope of extension. There must be agreement at every level to support this multidisciplined team approach.

PART VII

MARKETING AND PRICING POLICIES

THE COMPETITIVE POSITION OF THE PAKISTANI EDIBLE OILS MARKET: A TECHNICAL STUDY

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INTRODUCTION

The Pakistani edible oils sector consists of a complex set of domestic and international relationships that deny complete understanding due to increasing instability of international commodity markets and an extraordinary system of domestic price controls and subsidies. The Government of Pakistan continues to express interest in rationalizing its edible oils production system to ease conflicts among sharply rising demand, foreign exchange costs of imported oils and imperfections in the present marketing system.

This paper attempts to analyze and interpret the current edible oils market situation and to assess the competitive position of domestic oilseed crops. Specific objectives are to:

1. Identify the nature of benefits of the edible oils market to Pakistani society and assess their implications for new directions in edible oils' policy.

2. Assess the competitive position of oilseed crops under current pricing conditions and available technology.

3. Estimate linkages between the crop and livestock sectors with special emphasis on oilseeds.

4. Assess the potential for increasing domestic edible oil supply and recommend needed courses of action.

The paper is divided into five parts. The first section analyzes the contributions of the edible oils market to Pakistan's economic welfare. Part two analyzes the profitability of the oilseed crops that are potential sources of increased oil production. The third section estimates crop competition and linkages with other agricultural sectors. Part four presents a summary and conclusions from the paper's major analyses. The last section offers recommendations on needed courses of action to accommodate GOP desires for improving the edible oils market.

THE PAKISTANI EDIBLE OIL MARKET

Other oilseed design papers have described recent trends in domestic production and imports. The following analysis will concentrate on an approximation of the 1981-82 edible vegetable oils market and evaluate the relative importance of consumer and producer benefits and foreign exchange costs of imports.

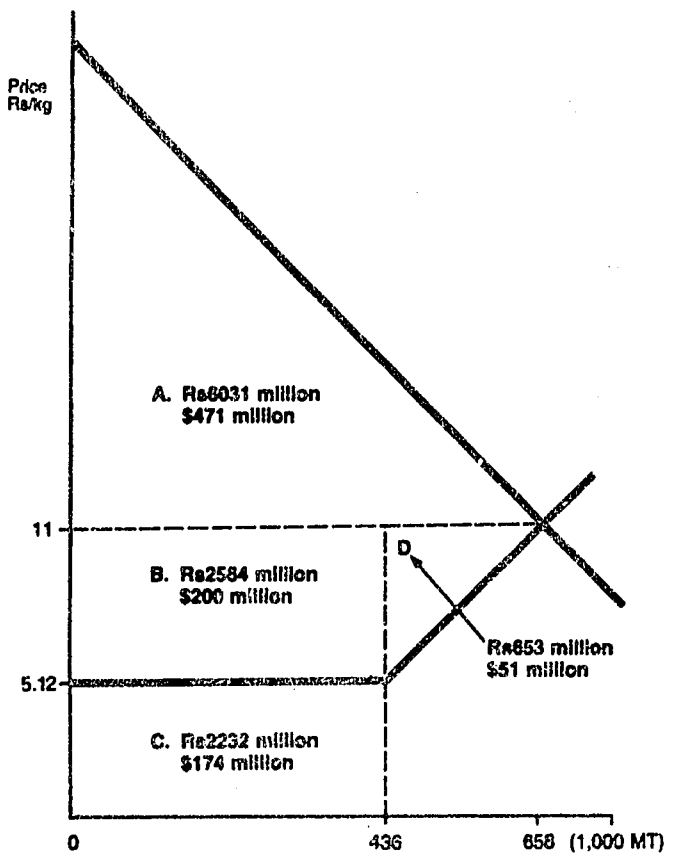
Demand

There are no reliable econometric estimates of the Pakistani edible oils demand structure, but some reasonable conditional estimates can be applied. A recent USDA/ERS study of food demand in Sri Lanka and other studies in India, Thailand and Indonesia suggest that the price elasticity of edible oil demand in Pakistan is becoming more inelastic and may be approximately -0.6, with an income elasticity of demand of between 1.1 and 1.3. As a practical matter, these elasticities assume that Pakistani consumers regard edible oils as a food necessity and consume them at an increasing rate as disposable income increases.

Figure 1 presents an estimate of the Pakistani edible oil demand curve based on approximate 1981-82 market conditions of 658,000 metric tons of edible vegetable oils consumed at a price of Rs 11 per kilogram.

Figure 1

Pakistan Edible Vegetable Oils Market, 1981/82



Supply

Figure 1 also includes a kinked supply curve to represent the imported and domestic components of edible oil supply. The horizontal portion of the supply curve assumes that 436,000 metric tons of oil were imported at Rs 5.12 per kg (U.S. $400 per MT). The remaining, positively sloped curve represents the domestic supply component. If the domestic supply curve were assumed to have a constant price elasticity throughout, the elasticity over the 436-658 range would be approximately 0.54 at the retail level.

This specification of the domestic supply function may seem heroic, but it is a reasonable expedient when two important points are considered: (1) there are no known econometric estimates of edible oil supply functions for developing countries; and (2) when the retail supply elasticity is reduced to the farm level in part four, the result is quite plausible.

Market Beneficiaries

Figure 1 shows four separate areas that are important measures of how edible oil market costs and benefits are distributed within Pakistani society. Area A is a triangle representing the net benefits accruing to edible oil consumers. Triangle D is an estimate of the net benefits gained by the producers, processors and distributors of imported palm and soybean oil. Finally, Rectangle C represents the potential foreign exchange cost of importing oil.

Several significant conclusions can be derived from Figure 1. First, the consumption of vegetable oils conveys enormous benefits to Pakistani consumers. Consumer benefits are about 11 percent greater than the combined producer-processor benefits and potential foreign exchange cost. If foreign exchange costs were regarded as a serious social cost, edible oil consumers could potentially pay those costs.

Second, Area B represents a massive marketing cost that is both a buffer to protect domestic oil producers who cannot compete with a Rs 5.12/kg import price and a strong disincentive to efficient marketing of imported and domestically produced oil. The Trading Corporation of Pakistan (TCP) sells imported oil at Rs 250 per 40 kg and currently nets about Rs 0.625 per kg of imported oil, or about U.S. $221.2 million on total annual imports. The Ghee Corporation of Pakistan (GCP) purchases oil from the TCP and incurs additional processing costs of approximately Rs 4.2 per kg of vanaspati and Rs 1.9 per kg of unhydrogenated oil before shipment to the retail market. It should be emphasized that the import price would be about 47 percent of the retail price if imported oil were selling for Rs 5,120 per MT (U.S. $400 per MT). If a significant part of this 53 percent "marketing margin" were transferred to the treasury, it would serve as an import tax. If most of Area B were retained by the processing and distribution

sector dominated by the GOP, it would contribute to enormous marketing inefficiencies and disincentives to process domestically produced oilseeds.

Third, the relatively large marketing margins for imported oil strongly suggest that Area D greatly underestimates the processing and distribution costs borne by the domestic sector.

Fourth, Area C is the foreign exchange cost of purchasing imported oil, but it may not always be a real national cost. About 95 thousand metric tons of soybean oil were imported through the PL-480, Title-I program during 1981-82. Additional concessionary sales of soybean oil also reduce the real foreign exchange drain. Malaysian palm oil imports are continuing to account for approximately one-half of foreign exchange costs. Given the low, real costs of U.S. soybean imports, the GOP faces a decision on future shares of domestic oils and imported palm oil. If the GOP decides to supply oil in concert with rising demands, the price of oil must be allowed to rise. If the retail price remains fixed, the GOP faces the clear prospect of increased importation of oil for an increased rate of growth in demand.

Finally, the current import price is falling and may remain below Rs 5,120 per MT for an intermediate period of 12-36 months. During the late 1970's imported oil prices were substantially higher, resulting in a relatively smaller Area B and a relatively larger Area C. Eventually, the imported oil price will rise and force the GOP to either reduce Area B or allow the retail price to rise with world prices.

The World Edible Oil Market

World Bank commodity trade and price trend data indicate that Rotterdam soybean prices have stayed in the high U.S. $200/MT range since 1973. Soybean oil prices have been much more variable, averaging about 2.2 times the bean price. Soybean meal prices have varied more than those of beans, but less than those of oil, averaging about 84 percent of bean prices.

Intermediate soybean prices are expected to be weak, primarily due to a relatively strong dollar, record U.S. soybean production and increased Brazilian and Argentine farm subsidies for foreign exchange earnings.

Malaysian palm oil is currently selling below the price of soybean oil. This seems to portend a major force for weak oil prices during the next decade. Malaysia has recently expanded plantings which will have a long-term, downward pressure on even groundnut and coconut oil prices. Also, the Cameroon weevil was introduced into Malaysian palm plantations two years ago. Palm pollination has improved and palm yields have risen as much as 15 percent due to the weevil. Malaysian palm oil will likely be the major Pakistani oil import after U.S. PL-480 and concessionary soybean sales because its price will remain low.

PROFITABILITY OF PAKISTANI OILSEED CROPS

The Pakistani Agricultural Research Council (PARC) promotes increased oilseed production through a breeding research program and publicity on yield and profitability potential. The yields commonly cited by PARC are often more than double those reported in Pakistani agricultural statistics. PARC is optimistic about the yield potentials of rapeseed, soybeans, safflower, and sunflower and emphasizes increased production to reduce the country's edible oil deficit. A closer examination of some oilseed yields' data and budgets reveals a tremendous gap between actual farm yields and "optimum" yields.

Oilseed Yields

PARC fertilizer response data were used to estimate production functions for rapeseed, soybeans, safflower and sunflower. Nitrogen was included in each function and phosphorus was included in the rapeseed and soybean models. Potassium was found to be an insignificant explanatory factor, although fertilizer replication methods are generally unsatisfactory for proper production function estimation. Fertilizer was entered in each function in either quadratic or cubic form. Various dummy variables were used to account for yield variation due to differences in varieties, irrigation and inoculation.

The estimated fertilizer coefficients satisfy second-order conditions for production maximization. The estimated equations, minus the dummy variables, were solved for maximum profit at alternative seed and fertilizer prices. Tables 1-4 show the results of a profit simulation of each oilseed. The first line of each simulation assumes fertilizer is free; thus the maximum yield is obtained. The last line simulates optimum yield under current assumed prices. Fixed cost is held at zero for demonstration purposes. The simulations predict yields that are three to four times actual field yields. Large amounts of fertilizer are predicted in the simulations; yet, typically, farmers apply no more than 25 kg per HT, and never to the rape plant.

The simulations show very little yield response as seed and fertilizer prices are varied. The physical response to variable fertilizer levels is also low. Although the plot data are plagued by poor experimental design, the production functions are well behaved and have coefficients of multiple determination from 0.66 (safflower) to 0.95 (soybeans). The production functions and the respective plot test yield data once again demonstrate the vast difference between experimental research results and actual farmer practices.

It might be argued that the farmers would attempt to produce the yields predicted by the functions if they only knew the appropriate technology and could acquire the other appropriate inputs.

Table 1. Optimum Fertilization Combinations per Hectare for Rapeseed.

Price Rs/Kg- Seed	N	P	Fixed Cost	Kg- N	P	Yield	Rs- Revenue	Cost	Profit
2	0	0	0	334	358	1560	3080	0	3080
2	3	2	0	203	201	1363	2726	650	2077
2	3	3	0	176	162	1275	2550	590	1960
2	3	4	0	149	124	1188	2335	530	1805
2	4.5	2	0	164	160	1250	2500	779	1721
2	4.5	3	0	137	122	1142	2284	679	1605
2	4.5	4	0	110	84	1014	2028	579	1449
2	6	2	0	125	120	1108	2216	792	1424
2	6	3	0	98	82	930	1959	651	1308
2	6	4	0	71	43	832	1664	511	1152
3	3	2	0	246	253	1461	4384	781	3604
3	3	3	0	228	220	1422	4267	748	3519
3	3	4	0	210	202	1375	4124	715	3408
3	4.5	2	0	220	226	1411	4234	1034	3200
3	4.5	3	0	203	201	1363	4089	974	3115
3	4.5	4	0	185	175	1306	3919	915	3005
3	6	2	0	195	199	1348	4044	1209	2835
3	6	3	0	177	174	1291	3873	1123	2750
3	6	4	0	159	148	1225	3676	1037	2640
4	3	2	0	268	279	1496	5984	846	5137
4	3	3	0	255	260	1474	5895	827	5068
4	3	4	0	241	241	1447	5788	808	4980
4	4.5	2	0	249	259	1468	5871	1161	4709
4	4.5	3	0	235	240	1441	5762	1122	4640
4	4.5	4	0	222	221	1409	5635	1083	4552
4	6	2	0	229	239	1432	5729	1418	4310
4	6	3	0	216	220	1400	5600	1359	4241
4	6	4	0	203	201	1363	5452	1299	4153
3.08	3.9	2.8	0	219	220	1405	4328	915	3413

Table 2. Optimum Fertilization Combinations per Hectare for Soybean.

Price Rs/Kg- Seed	N	P	Fixed Cost	Kg- N	P	Yield	Rs- Revenue	Cost	Profit
3	0	0	0	222	87	2685	8050	0	8050
3	3	2	0	131	86	2638	7913	434	7478
3	3	3	0	131	85	2637	7911	456	7455
3	3	4	0	131	84	2636	7909	477	7432
3	4.5	2	0	83	86	2581	7743	426	7317
3	4.5	3	0	85	85	2580	7741	447	7293
3	4.5	4	0	86	84	2579	7738	469	7270
3	6	2	0	40	86	2501	7504	281	7223
3	6	3	0	40	85	2501	7503	303	7200
3	6	4	0	40	84	2500	7500	324	7176
4.5	3	2	0	161	86	2663	11984	525	11459
4.5	3	3	0	161	86	2663	11983	546	11436
4.5	3	4	0	161	85	2662	11981	568	11414
4.5	4.5	2	0	131	86	2638	11871	631	11240
4.5	4.5	3	0	131	86	2638	11869	652	11218
4.5	4.5	4	0	131	85	2637	11868	673	11195
4.5	6	2	0	100	86	2605	11712	645	11067
4.5	6	3	0	101	86	2602	11710	665	11044
4.5	6	4	0	101	85	2602	11709	687	11021
6	3	2	0	176	87	2672	16032	571	15462
6	3	3	0	176	86	2672	16031	592	15440
6	3	4	0	176	86	2672	16030	613	15417
6	4.5	2	0	153	87	2658	15947	733	15214
6	4.5	3	0	154	86	2658	15946	754	15192
6	4.5	4	0	154	86	2657	15945	775	15170
6	6	2	0	131	87	2638	15828	827	15001
6	6	3	0	131	86	2638	15827	848	14979
6	6	4	0	131	86	2638	15826	869	14957
3.05	3.9	2.8	0	106	85	2608	7956	470	7485

Table 3. Optimum Fertilization Combinations per Hectare for Safflower.

Price Rs/Kg- Seed	N	P	Fixed Cost	Kg- N	P	Yield	Rs- Revenue	Cost	Profit
3	0	0	0	133	0	1060	3181	0	3181
3	3	2	0	110	0	1049	3147	373	2774
3	3	3	0	110	0	1049	3147	394	2753
3	3	4	0	110	0	1049	3147	415	2732
3	4.5	2	0	99	0	1035	3105	488	2617
3	4.5	3	0	99	0	1035	3105	509	2596
3	4.5	4	0	99	0	1035	3105	530	2575
3	6	2	0	88	0	1015	3046	569	2477
3	6	3	0	88	0	1015	3046	590	2456
3	6	4	0	88	0	1015	3046	611	2435
4.5	3	2	0	118	0	1055	4749	396	4353
4.5	3	3	0	118	0	1055	4749	417	4332
4.5	3	4	0	118	0	1055	4749	438	4311
4.5	4.5	2	0	110	0	1049	4721	539	4182
4.5	4.5	3	0	110	0	1049	4721	560	4161
4.5	4.5	4	0	110	0	1049	4721	581	4140
4.5	6	2	0	103	0	1040	4681	659	4022
4.5	6	3	0	103	0	1040	4681	680	4001
4.5	6	4	0	103	0	1040	4681	701	3980
6	3	2	0	122	0	1058	6346	407	5938
6	3	3	0	122	0	1058	6346	428	5917
6	3	4	0	122	0	1058	6346	449	5896
6	4.5	2	0	116	0	1054	6324	546	5760
6	4.5	3	0	116	0	1054	6324	585	5739
6	4.5	4	0	116	0	1054	6324	606	5718
6	6	2	0	110	0	1049	6295	705	5590
6	6	3	0	110	0	1049	6295	726	5569
6	6	4	0	110	0	1049	6295	747	5548
3	3.9	2.8	0	104	0	1041	3124	463	2661

Table 4. Optimum Fertilization Combinations per Hectare for Safflower.

Price Rs/Kg- Seed	N	P	Fixed Cost	Kg- N	P	Yield	Rs- Revenue	Cost	Profit
3	0	0	0	137	0	1041	3122	0	3122
3	3	2	0	106	0	1023	3070	360	2710
3	3	3	0	106	0	1023	3070	381	2689
3	3	4	0	106	0	1023	3070	402	2668
3	4.5	2	0	96	0	1012	3036	473	2563
3	4.5	3	0	96	0	1012	3036	494	2542
3	4.5	4	0	96	0	1012	3036	515	2521
3	6	2	0	90	0	1004	3013	579	2434
3	6	3	0	90	0	1004	3013	600	2413
3	6	4	0	90	0	1004	3013	621	2392
4.5	3	2	0	104	0	1021	4594	353	4241
4.5	3	3	0	104	0	1021	4594	374	4220
4.5	3	4	0	104	0	1021	4594	395	4199
4.5	4.5	2	0	106	0	1023	4604	518	4086
4.5	4.5	3	0	106	0	1023	4604	539	4065
4.5	4.5	4	0	106	0	1023	4604	560	4044
4.5	6	2	0	99	0	1015	4569	633	3936
4.5	6	3	0	99	0	1015	4569	654	3915
4.5	6	4	0	99	0	1015	4569	675	3894
6	3	2	0	141	0	1040	6241	465	5777
6	3	3	0	141	0	1040	6241	486	5756
6	3	4	0	141	0	1040	6241	507	5735
6	4.5	2	0	108	0	1025	6152	528	5624
6	4.5	3	0	108	0	1025	6152	549	5603
6	4.5	4	0	108	0	1025	6152	570	5582
6	6	2	0	106	0	1023	6139	677	5462
6	6	3	0	106	0	1023	6139	698	5441
6	6	4	0	106	0	1023	6139	719	5420
3.5	3.9	2.8	0	103	0	1020	3871	461	3110

This view is not convincing when the shortcomings of the oilseed marketing system are considered. The GCP occupies a dominant position in the procurement of oilseeds. At planting time it regularly promises to buy farmers' seed crops. At harvest time few, if any, of the promised orders are filled by GCP and payments for orders can be delayed for several months. Farmers are likely to discount the quoted farmgate price by far more than transportation costs from the farmgate to the seed wholesaler. The farmers' expected price could be as low as one-third the quoted farmgate price.

Crop Costs and Returns

Appendix B presents budgets estimated for 11 major crops in NWFP, Punjab and Sind provinces. Monthly land and labor utilization data were extrapolated primarily from a data base prepared by the World Bank (WB) and the Water and Power Development Authority (WAPDA) for a linear programming model of the Indus River Valley irrigation system. Nitrogen price was assumed to be Rs 3.9 per kg and the phosphorous price was assumed to be Rs 2.8 per kg. Other operating costs were estimated by adjusting WB/WAPDA costs from 1975-76 to 1981-82 levels. Yields were estimated by considering WB/WAPDA data, agricultural statistics, Oilseed Development Board estimates and GCP estimates. The estimated yields are assumed to reflect current technology under improved marketing conditions. Variable costs do not include labor, management or land costs, and are listed as "VAR" to signify that they are approximated without direct measures of each variable cost component.

In the NWFP sunflower and soybeans have higher net returns than mustard-rape seed. Maize is a key crop with net returns exceeded only by sugarcane and sunflower.

In Punjab Province wheat has higher net returns than maize, mustard-rapeseed or soybeans. Sunflower net returns are exceeded only by sugarcane.

In Sind Province sunflower net returns are again exceeded only by sugarcane, but wheat is more profitable than mustard-rapeseed or safflower.

Any comparison of oilseed profitability must consider both seasonal demands for land and labor and the rotation patterns that are most appropriate for a farmer's particular enterprise system. The budgets in Appendix B include monthly land and labor requirements. No detailed farm management studies are currently available on the timing and rotation of major enterprises. Without firm estimates of actual rotation practices, the relative profitability of crops is made more difficult. A casual review of Appendix B would suggest that each province would be planted entirely in sugarcane, the most profitable crop on an acre basis, if marketing limitations and historical sugarcane acreage patterns were not considered. The budgets strongly suggest that

sunflower is a profitable oilseed crop, but the intra-seasonal competition for land and labor also must be considered.

OILSEED CROP COMPETITION AND LINKAGES

The present domestic edible oilseed industry consists of cotton and rape, but almost no sunflower, soybean or safflower production. Therefore, the simulation of nontraditional oilseed production is complicated due to limited historical experience for comparison with the current situation. Despite these limitations there is an important need for an assessment of the competitive position of the oilseed industry and an analysis of its potential for expansion.

Domestic oilseed production is clearly not competitive with the present imported prices of soybean oil and palm oil (U.S.$400 per MT). However, the large margin between imported oil prices and the retail ghee price affords a considerable incentive for domestic production. Since domestic production meets only approximately one-third of total edible vegetable oil requirements, it is important to determine whether there are resource or technological limitations that will restrict domestic production without luring resources from other enterprises or requiring substantial investments in new technology.

A Linear Programming Model

The WB/WAPDA linear programming (LP) model was developed to create optimum irrigation water utilization and control strategies for the 30 million acres of irrigated land within the Indus River Valley Irrigation System. The competitive position of mustard-rape, sunflower, soybean, safflower and cottonseed at current prices and technology was evaluated with an LP model derived in part from the WB/WAPDA model.

An objective function was specified to include net revenue for each major field crop in the three provinces covered by the WB/WAPDA model. Additional activities would include monthly labor purchases at Rs 2 per hour if family labor were unavailable. Edible vegetable oil and oilseed meal were specified as products of oilseed crop production according to the oilseed crop budgets in Appendix B. Edible vegetable oil was specified as a retail sale activity based on a retail price of Rs 11 per kg and a 40 percent marketing margin or value added of Rs 4.4 per kg.

An oilseed meal purchasing activity was included as another oilseed crop activity based on a sale price of Rs 2.6 per kg and a marketing value added of Rs 1.04 per kg. Oilseed meal and forages were specified as prime inputs for milk production, assuming a market price of Rs 2 per kg and a value added of Rs 1.2 per kg. Finally, poultry production was specified as the

product of oilseed meal, wheat and maize inputs assuming a poultry meat price of Rs 24 per kg and a value added of Rs 7 per kg.

Each province was specified as a subsector of a national LP model. The provincial models are highly aggregated and fail to distinguish subtle enterprise conflicts that increase farmer risk and uncertainty due to the lack of data on farm-level cropping patterns and enterprise mixes. During the past decade, total acreages of the major field crops have shifted in response to changing product and input price ratios and subsidy schemes. These acreage shifts are important indicators of the capacity for increasing oilseed crop acreage without diminishing that of other major field crops. Table 5 presents zero-order correlations for the major field crops in the Indus River Valley provinces during the past decade.

Table 5

Zero-Order Correlation Coefficients for 1971-80 Crop Acreages in NWFP, Punjab and Sind Provinces

	Wheat	Maize	Cotton	Sugar-Cane	Rice	Gram	Mustard-Rape
Maize	.33						
Cotton	.30	.06					
Sugarcane	.73	.09	-.10				
Rice	.90	.03	.15	.82			
Gram	.12	-.07	-.58	.12	.32		
Mustard-Rape	-.74	.00	-.30	-.76	-.90	-.15	
Trend	.95	.17	.27	.86	.96	.10	-.89

Wheat, sugarcane and rice acreages have increased over time. Mustard-rape acreage has shown a significant decrease over time compared with wheat, sugarcane and rice acreages. Maize and gram acreages are relatively small and do not appear to have any significant association with the major field crop acreage shifts. Cotton acreage is shifting southward but it is not significantly associated with shifts in other major field crop acreages.

The LP model assumes that value added to the farmgate values of edible vegetable oils and meals by market processing and distribution activities is approximately 40 percent of the retail price. Table 6 presents the assumed farmgate oilseed, retail edible oil and wholesale oilseed meal prices that were used to calculate marketing (value added) margins for domestically

produced oilseeds under improved management conditions with current technology. These margins do not consider other oilseed by-products such as soapstock and lint, and therefore slightly underestimate oilseed revenues and slightly overestimate oil and meal marketing costs.

Calibration of the LP Model

The WB/WAPDA LP model is based largely on total resource and enterprise budget estimates. These estimates were in turn based on a series of intensive farm management surveys conducted in nine major agroclimatic zones in 1975-76. The zones were identified as: (1) Northwest Frontier Province (NWFP); (2) Punjab Mixed Wheat (PMW); (3) Punjab Cotton Wheat (PCW); (6) Sind Cotton Wheat North (SCWN); (7) Sind Rice Wheat North (SRWN); (8) Sind Cotton Wheat South (SCWS); and (9) Sind Rice Wheat South (SRWS). Benchmark resource estimates from the model were aggregated to the province level as shown in Appendix A-1.

The aggregated WAPDA model resource levels were compared with 1975-76 provincial agricultural statistics to assess the model's coverage of provincial resources and its relative contributions to national production. Appendix A-2 shows the WAPDA model is a reasonably good approximation for rice, cotton, maize, wheat and total irrigated acreage.

Crop acreage and population changes between 1975-76 and 1981-82 were used to adjust each provincial submodel's resource base or right-hand side (RHS) to estimated 1981-82 levels. Acreage flexibility restrictions were specified to force all crops except rapeseed-mustard, soybeans, sunflower and safflower into the models at levels equal to or greater than estimated 1981-82 levels. Each model must therefore produce all other crops first (including cotton), and oilseed crops only if additional land and labor resources are available and crop net revenues are competitive.

Appendix C shows the basic LP tableau for each province submodel. The objective function of each model maximizes net revenue and value added subject to monthly labor and land restrictions and acreage flexibility restrictions on all non-oilseed crops (except cotton). Restrictions on forage (FORA), oilseed meal (MEAL), edible vegetable oils (OIL), maize tonnage (MAIZT) and wheat tonnage (WHEAT) are transfer activities to supply OIL, MEAL, POUL AND MILK activities with resources from the crops sector.

Results

Table 7 presents the results of the optimum feasible solution of each provincial model as specified in Appendix C. The acreages of wheat, rice, maize, sugarcane, gram and cotton equal or exceed estimated 1981-82 levels. The edible oil, oilseed meal, poultry meat and milk production levels are production potentials based

Table 6
Estimated Oilseed Marketing Costs and Margins

Oilseed	Farm Price Rs/Kg	Oil Price Rs/Kg	Meal Price Rs/Kg	Oil %	Meal %	Oil --Rs/MT---	Meal	Margin
Cotton	1.75	11.00	2.00	11.00	82.00	4246	772	.39
Soybean	3.05	11.00	4.00	17.57	79.66	4446	1617	.40
Rapeseed	3.08	12.00	1.50	32.88	61.99	4419	552	.37
Sunflower	3.50	12.40	3.60	38.90	30.37	5065	1471	.41
Safflower	3.00	13.00	2.00	32.00	65.00	5857	901	.45

Table 7
Linear Programming Results

	NWFP	Punjab	Sind	Total
	----------1,000 Acres----------			
Wheat	440	9920	2475	12835
Rice		3091	2157	5248
Maize	315	1220	263	1798
Sugarcane	200	1642	228	2070
Gram	1	526	788	1315
Cotton		3662	1256	4918
Mustard-Rape				0
Sunflower	95	9490	3066	12651
Safflower			3952	3952
Soybean		11228		11228
	-------1,000 Metric Tons--------			
Wheat	212	6063	1888	8163
Maize	211	684	69	964
Lint		465	202	667
Oil	17	2650	954	3621
Meal	13	6064	1396	7473
Poultry Meat	13	1138	113	1264
Milk	21	23487	5355	28863
	-------Shadow Prices (Rs)--------			
Wheat (MT)	6147		1820	
Maize (MT)	4978	11177	11167	
Forage (MT)	181	181	181	
Gram Acreage	4951	1549	1190	
Sugarcane Acreage	2616	2965	949	
Wheat Acreage		1312		
Maize Acreage		3700	1258	
Cotton Acreage		2339	1133	
Rice Acreage		2191	1242	
January Acreage			371	
February Acreage	1422			
April Acreage		1356		
May Acreage			213	
October Acreage	3637	2829	1623	

on the assumptions of Appendix C and should be viewed as even intermediate term possibilities without substantial changes in oilseed policy. The acreage estimates for mustard-rapeseed and the nontraditional oilseeds are assumed to be production potential with remaining resources after all other major field crops have been produced.

It should be noted that each province currently devotes considerable acreage to rapeseed-mustard production, yet no rapeseed-mustard production enters any province production scheme. A close inspection of Appendix B shows that sunflowers are far more profitable than rapeseed-mustard which also must compete with wheat production for winter land. Despite the model's preference for sunflower, soybeans and safflower, there is no reason to believe that mustard-rapeseed production will soon decline to insignificance.

Two sunflower cropping schemes were included in the Punjab. The northern crop (January planting) entered the optimum solution while the southern crop (July planting) was crowded out by soybeans (July planting).

The shadow prices at the bottom of Table 7 represent perhaps the most important findings of the LP model. In a constrained maximization problem such as LP, a resource contributing to the objective function (maximum net revenue or value added) gains a shadow price when it has become exhausted. The shadow price measures the contribution to the objective function if one more unit of the resource were made available to the model. The shadow prices in Table 7 indicate the model's estimate of the contribution of one more unit (MT or acre) or an exhausted resource to the total value of the objective function.

Various resource restrictions limit the production of wheat in NWFP and Sind Province. The NWFP wheat shadow price is Rs 6,147 per metric ton compared with an assumed market price of only Rs 1,450 per MT. The relatively higher shadow price is due to the value wheat contributes to the assumed poultry ration in Appendix C-1. The same analysis shows that the model values maize much higher than its market price because it also plays a major role in poultry production. Crop acreage shadow prices are generally much higher than the respective net revenue values in Appendix B. The monthly acreage shadow prices indicate land availabilities have been exhausted. The monthly land shadow prices can be regarded as potential land rental prices for the respective months and provinces.

Oilseed meal was assumed to have a wholesale price of Rs 2,600 per metric ton. The model suggests that domestic oilseed meal can compete with current imported soybean prices of more than U.S. $300 per ton. (Appendix D-1 shows an accounting of recent soybean meal import pricing.)

The linear programming results summarized in Table 7 should be evaluated with respect to the following limitations:

1. The analysis is appropriate only for the irrigated lands within the Indus River Valley.

2. The model does not allow detailed farm-level specification of crop rotations and enterprise mixes reflecting the farmer's perception of risk and uncertainty.

3. The farmer is assumed to receive 100 percent of the product prices used in Appendix B, although there is ample reason to believe that severe marketing inefficiencies sharply reduce expected farm prices for nontraditional oilseeds.

4. Poultry and milk feed conversion ratios and values added have been estimated on a far more conservative basis than is likely in actual practice.

5. No water constraints are included in the model although evidence suggests that by expanding acreage, oilseed crops will not compete for scarce water during the intermediate term.

6. None of the estimated monthly family labor availabilities are exhausted, primarily because the model does not include fruit, vegetable, other minor field crops and livestock production activities.

7. The milk and poultry meat production possibilities assume there is sufficient breeding and production stock to utilize all domestically produced feeds.

CONCLUSIONS

The Pakistani edible vegetable oil sector is creating serious foreign exchange drains, yet domestic production is stagnant despite substantial protection from imported oil prices. The preceding analysis and discussions with other oilseed design team members suggest specific conclusions about oilseed market linkages, market efficiency and the potential for expanding domestic edible oilseed production.

Domestic Oilseed Crop and Livestock Linkages

The linear programming analysis indicates tremendous potential for expanding poultry meat and milk production by utilizing meal by-products of oilseed production. The model estimates poultry meat and milk production levels far above the present level. Not

all the oilseed meal produced in the model can be utilized due to production limitations on wheat and maize. These results strongly suggest there is great potential for expanding the poultry industry, but a large energy deficit (a maize-equivalent shortage) is possible in the near future. Significant poultry production, breeding and feed manufacturing capacity is already in place. As domestic oilseed production increases, the poultry sector will constitute a strong and growing demand for high-quality, low-fiber oilseed meal.

Imported and Domestic Edible Oil Linkages

Imported edible vegetable oil prices are likely to be depressed for at least the next 12 to 36 months. If the present domestic price structure of imported oil prices is maintained, there is ample price incentive to expand domestic oilseed production. If the GOP does not take decisive action to ensure effective price incentives at the farm and processing levels, a major opportunity to increase domestic edible oil production will be wasted.

The GOP stands at an important crossroads of oil import policy. Palm oil prices have fallen sharply during the past two years and may ultimately reach U.S. $300 per MT. The GOP faces a major decision on whether to continue purchasing even cheaper palm oil at the expense of domestic production incentives. U.S. soybean oil sales are presently quite attractive to the GOP. If present U.S. trade policies continue, the GOP also will find it difficult to reduce purchases of cheap U.S. soybean oil if domestic oil production cannot be stimulated. The real price of imported edible oil will continue to decline throughout the next decade. However, when short-run increases in import prices occur, the GOP should respond by allowing those price increases to stimulate domestic oilseed production.

Edible Oil Market Inefficiency

The current price protection for domestic oil production (Area B, Figure 1) and the GOP's dominant position in the market constitute severe disincentives to efficient marketing. The actions of the GOP suggest that the ease of processing imported oil is much preferred to the task of expanding domestic oilseed crops and processing the resulting oil and meal. GOP procurement of non-traditional oilseeds is erratic and effectively discourages many farmers from oilseed production.

The current high oil content of various oilseed cakes is commonly explained to be the result of cattle and buffalo owners' preference for high-energy feed. The structure of oil, meal, cake and seed prices suggests that oil is underpriced. If the GOP is concerned about an edible oil deficit, it should consider whether supposedly scarce, valuable oil is an appropriate ruminant feed.

Oilseed processors are not going to extract a higher percentage of oil at present prices. If oil prices are to be increased it should be done at the retail level. Such action would be costly to consumers (reduce the size of Area A, Figure 1) but would ultimately lure more oil out of present oilseed production by sending improved price signals to the oilseed processing industry.

Expanded Oilseed Production Potential

The results of this study strongly suggest there is ample opportunity to expand edible vegetable oil production at present prices without reducing production of major field crops (wheat, rice, sugarcane and cotton). The degree of production potential cannot be precisely estimated because there are no farm management research results on oilseed crop rotation on typical farms. Since nontraditional oilseed production is almost nonexistent, there is little historical experience to use in predicting future production trends.

The LP results indicate that, in the aggregate, tremendous acreages within the Indus River Valley Irrigation System are theoretically available for oilseed production, but they cannot account for the risk, uncertainty and enterprise indivisibilities common to every farm firm. Until practical farm management research on the economics of farm-level oilseed cropping systems is available, accurate forecasts of oilseed production response will not be possible.

An alternative approach to oilseed production potential merits consideration, given the overestimates that are common to LP methods. If the retail price elasticity of domestic edible vegetable oil supply is 0.54, as derived in the first section, the farm-level supply elasticity must be lower. If the farm share of the domestic edible oil expenditure by consumers is 0.6 (Table 6), the farm supply elasticity is probably no greater than 0.32. Based on other supply response studies, it could easily be as low as 0.2.

There is strong evidence that the farmgate price has a high variance due to limited seed procurement by GCP. There is no empirical evidence on oilseed price risk, but it could easily be two-thirds of the broker-quoted farmgate price. If present marketing methods were improved and the farmer were virtually certain of receiving the price quoted by the broker, the expected farmgate price might even be tripled. Such an effective increase would result in increased farm edible oil production of between 40 percent (a 0.2 supply elasticity) and 64 percent (a 0.32 supply elasticity). Given last year's assumed domestic oil production of 222,000 metric tons, the potential supply response due to improved oilseed procurement and marketing could be from 89,000 to 142,000 additional tons.

Based on Punjab sunflower equivalents, these additional tons of oil would require between 509,000 and 811,000 additional oilseed acres to be cultivated. Such production would yield an additional 69,000 to 110,000 metric tons of oilseed meal.

These results may seem disappointingly small compared with the LP model's attempts to cover the Indus Valley with sunflowers, but the estimated supply elasticity ranges are quite plausible. However, even the lower estimated supply response--all other things held constant--would reduce Area D in Figure 1 (foreign exchange costs) by 20 percent.

RECOMMENDATIONS

No significant progress in domestic edible oilseed production can be expected until several closely coordinated actions are implemented by the GOP. These actions should be undertaken to improve market performance, thereby improving the market's ability to send correct price signals to farmers, processors and consumers.

Improved Performance in the Imported Oil Market

The present procedures for importing edible oil encourage inefficiency and create disincentives to further domestic production. The GCP should be abolished and its role in processing and distributing imported oil assumed by the private sector. If the present margin between the TCP sale price and the retail cooking oil prices is to be preserved, private processors should be allowed a margin of about Rs 2.4 per kg (Rs 3.4 per kg of fully hydrogenated vanaspati) and all the remaining margin collected as a tax by the GOP treasury.

Improved Market Performance in the Domestic Oilseed Market

The oilseed procurement activities currently performed by the GCP should be directed to the private sector. It is difficult to imagine the supposed losses from cheating by middlemen being greater than the current production losses from GCP's counterproductive procurement program.

Reorganization of Edible Oil Authorities

The current maze of conflicting interests and ineffective lines of authority among TCP, GCP, the Ministry of Finance, the Ministry of Commerce, the Ministry of Food, Agriculture & Cooperatives, PARC and the Oilseeds Development Board represent a strong need for assignment of new responsibilities and the commensurate delegation of authority by the GOP. Abolition of the GCP and denationalization of its processing plants should be the

first priority in redirecting national edible oil policy. The Ministry of Agriculture should strengthen the Oilseeds Development Board to give it broader powers over PARC's oilseed research efforts and provincial research and development efforts, but avoid any role in market intervention.

Cooperative Oilseed Research and Development with Farmers

The Ministry of Agriculture should establish a few research and development programs on typical farms in areas currently producing oilseeds or having high potential for production. Selected farmers should be given access to current information on oilseed production and marketing techniques, but they should not be given extraordinary inducements to begin or expand oilseed production. Their crop rotation systems and enterprise combinations should be jointly studied by farm management specialists to determine improved ways of incorporating oilseed production into farming plans. The farmers should also be queried about local marketing practices and their reasons for continuing to cultivate oilseeds considered as urgent policy problems by the Oilseeds Development Board.

Poultry Development Assistance

The Pakistani poultry industry is on the verge of dramatic growth. One of the major constraints is poor feed quality. A pilot program should be implemented to acquaint the industry with potential benefits of domestic oilseed production. The program also should include demonstration and information programs on feed formulation and mixing techniques.

APPENDIX TABLE A-1

BENCHMARK ACREAGE, RESOURCE ESTIMATES FROM LAPSA MODEL BY AGROCLIMATIC ZONE, 1975-76

	1	2	3	4	5	6	7	8	9		SUMMARY		
	NWFP	PNW	PCW	PSW	PRW	SCWW	SRWW	SCWS	SRWS	TOTAL	NWFP	PNWAB	SRWS
Rice	3	51	781	509	1,056	239	1,126	44	264	4,072	3	2,396	1,673
Cotton	4	164	2,068	486	180	464	67	627	110	4,972	4	3,699	1,269
K. Fodder	37	424	1,539	429	252	230	114	205	24	3,254	37	2,644	573
Maize	301	91	419	347	158	57	54	87	24	1,557	301	1,034	232
R. Fodder	4	164	2,692	486	180	464	67	627	110	4,996	4	3,722	1,269
Gram	1	144	197	75	41	250	360	29	45	1,143	1	457	685
Mustard-Rape	5	93	431	69	53	78	109	72	21	931	5	646	280
Wheat	286	963	4,398	1,980	1,606	590	518	684	141	11,156	286	8,937	1,933
Sugarcane	155	109	536	420	209	74	14	60	29	1,605	155	1,273	177
Irrigated Area	629	2,085	11,063	4,455	3,294	2,209	2,194	1,949	1,166	29,044	629	20,897	7,518
1000 Population	1,270	1,791	7,163	3,572	2,718	1,570	1,761	1,131	663	21,638	1,270	15,243	5,125
1000 Hours	58,576	116,558	459,770	227,618	161,673	96,357	126,931	64,441	37,502	1,349,627	58,576	965,820	325,231
Tractors	1,124	1,827	12,757	6,225	5,680	1,156	696	1,050	787	31,302	1,124	26,489	3,689
Bull Pairs	82,719	191,509	864,173	393,507	232,289	186,405	216,930	14,329	119,739	2,421,561	82,719	1,681,477	657,365
Buffalo	118,597	238,554	1,724,512	1,240,050	1,075,727	334,036	341,462	208,831	226,586	5,516,355	118,597	4,286,043	1,110,915
Cattle	106,446	394,968	879,698	336,882	230,922	243,308	278,295	237,459	175,061	2,683,029	106,446	1,842,460	934,123

NOTE:
Rice through irrigated area are in 1,000 acre units. MHS denotes man hours of family labor available.

APPENDIX TABLE A-2

WAPDA Model as a Percent of Province and National Agricultural Statistics

	NWFP	Punjab	Sind	Total	Country
Rice	2	111	93	99	96
Cotton	72	108	111	109	109
K. Fodder	NA	NA	NA	NA	NA
Maize	40	145	411	102	102
R. Fodder	NA	NA	NA	NA	NA
Gram	0	24	138	43	43
Mustard-Rape	4	87	106	82	80
Wheat	16	81	98	76	74
Sugarcane	67	103	68	93	93
Irrigated Area	39	70	96	89	86
1000 Population	16	50	56	46	41
1000 Hours	NA	NA	NA	NA	NA
Tractors	49	93	98	91	89
Bull Pairs	NA	NA	NA	NA	NA
Buffalo	16	54	61	52	52
Cattle	4	23	33	21	19

NOTE:
Data on fodder and bull pairs are not available from Pakistan Agricultural Statistics. WAPDA population estimates are compared with extrapolated population estimated from the Pakistan 1972 and 1981 Censuses.

APPENDIX TABLE B-1.

Cost and Returns Assumptions per Acre for Maize

	NWFP	Punjab	Sind
Yield (MDS)	18	15	7
kg	673	561	262
N (kg)	17.6	22	10.5
P (kg)	5.7	7	5
Price/kg	2.4	2.4	2.4
Labor (hours)			
Jan			
Feb			
Mar			
Apr			
May			1.5
Jun	43.4	2.3	4.2
Jul	38.6	8.3	3.7
Aug	.7	44.2	3
Sep	2.7	2.5	3
Oct	46.1	25	3
Nov		25	38
Dec			
Total	131.5	107.3	76.4
Land (AC)			
Jan			
Feb			
Mar			
Apr			
May			.25
Jun	1		.75
Jul	1	1	1
Aug	1	1	1
Sep	1	1	1
Oct	1	1	1
Nov		1	.5
Dec		.5	
Total	5	5.5	5.5
Water (AF)	1.25	1.4	1.92
Seed (SR)	12.4	9.9	9.3
Forage (MDS)	33.4	30	18
kg	1247	1120	672
Revenue	1615	1346	628
'VAR' Cost	660	747	521
Net Revenue	955	599	107

APPENDIX TABLE B-2.

Cost and Returns per Acre for Mustard-Rape

	NWFP	Punjab	Sind
Yield (MDS)	5.6	6.5	6.5
kg	269	243	243
Oil %	32.80	32.80	32.80
Oil kg	69	80	80
Cake/Meal %	61.27	61.27	61.27
Cake/Meal kg	120	149	149
N (kg)			
P (kg)			
Price/kg	3.08	3.08	3.08
Labor (hours)			
Jan		22.75	20.6
Feb		13.5	13.8
Mar		11	1.5
Apr			
May			
Jun			
Jul	8.9		
Aug	10.5		
Sep	18	1.54	8.5
Oct	14.6	3.8	3.1
Nov	23	3.1	1.5
Dec	23	18.9	16.5
Total	98	74.59	65.5
Land (AC)			
Jan		1	1
Feb		1	1
Mar		.85	.85
Apr			
May			
Jun			
Jul	1		
Aug	1		
Sep	1	.2	.2
Oct	1	1	1
Nov	1	1	1
Dec	1	1	1
Total	6	6.05	6.05
Water (AF)	1.15	1.1	1.2
Seed (SR)	2.33	2.65	3.5
Forage (MDS)	2.1	2.9	2.5
kg	78	108	93
Revenue	645	749	749
'VAR' Cost	93	100	86
Net Revenue	552	649	662

APPENDIX TABLE B-3.

Cost and Returns Assumptions per Acre for Cotton

	NWFP	Punjab	Sind
Yield (MDS)		3.4	4.3
kg (Lint)	0	127	161
kg (Seed)	0	254	322
Oil %	11	11	11
Oil Kg	0	28	35
Cake/Meal %	82	82	82
Cake/Meal kg	0	209	264
N (kg)		16.5	25.1
P (kg)		4.75	10.2
Price/kg		1.75	1.75
Labor (hours)			
Jan			
Feb			
Mar			
Apr		10.1	14.5
May		8.4	13.9
Jun		20.2	7
Jul		2.5	2
Aug		6.9	2
Sep		12.8	36.1
Oct		43.6	79.3
Nov		55.4	
Dec		23.8	
Total	0	183.7	154.0
Land (AC)			
Jan			
Feb			
Mar			
Apr		.3	.55
May		1	1
Jun		1	1
Jul		1	1
Aug		1	1
Sep		1	1
Oct		1	1
Nov		.85	
Dec			
Total	0	7.15	6.55
Water (AF)		2.04	2.1
Seed (SR)		6.6	10.7
Forage (MDS)		71.4	68
kg	0	2666	2539
Revenue	0	445	563
'VAR' Cost	0	213	337
Net Revenue	0	232	226

APPENDIX TABLE B-4.

Cost and Returns Assumptions per Acre for Wheat

	NWFP	Punjab	Sind
Yield (MDS)	12.9	18.2	20.4
kg	482	681	763
N (kg)	18.7	19.4	19.7
P (kg)	4.1	6.9	8.7
Price/kg	1.45	1.45	1.45
Labor (hours)			
Jan	5.0	4.4	3.2
Feb	3.7	3.9	3.2
Mar	3.7	3.7	16.4
Apr	55.3	52.7	14.7
May	18.8	19.2	
Jun			
Jul			
Aug			
Sep			
Oct	4.1	2.1	
Nov	9.7	14.6	10.7
Dec	3.7	3.9	3.2
Total	104.8	104.5	51.4
Land (AC)			
Jan	1	1	1
Feb	1	1	1
Mar	1	1	1
Apr	1	1	.25
May			
Jun			
Jul			
Aug			
Sep			
Oct	.5	.1	
Nov	1	1	1
Dec	1	1	1
Total	6.5	6.1	5.25
Water (AF)	1.5	1.08	1.06
Seed (SR)	33.87	41.1	43.9
Forage (MDS)	43.3	48.4	45.9
kg	1617	1807	1714
Revenue	699	987	1106
'VAR' Cost	254	276	294
Net Revenue	445	711	812

APPENDIX TABLE D-5.

Cost and Returns Assumptions per Acre for Rice

	NWFP	Punjab	Sind
Yield (MDS)	0	15.2	19.7
kg		568	737
N (kg)		18.3	14.3
P (kg)		6.9	2.8
Price/kg	1.63	1.63	1.63
Labor (hours)			
Jan			
Feb			
Mar			
Apr			3.4
May			17.8
Jun		30.1	16.9
Jul		98.6	17.4
Aug		40.5	30.1
Sep		6.9	18.5
Oct		5.7	21.6
Nov		47.2	23.8
Dec		20.1	3.5
Total	0	249.1	153
Land (AC)			
Jan			
Feb			
Mar			
Apr			.1
May			.9
Jun		1	1
Jul		1	1
Aug		1	1
Sep		1	1
Oct		1	1
Nov		1	
Dec			
Total	0	6	6
Water (AF)		3.6	4.2
Seed (SR)		7.6	24.6
Forage (MDS)		81	84.5
kg	0	3025	3156
Revenue	0	926	1201
'VAR' Cost	0	247	207
Net Revenue	0	680	994

APPENDIX TABLE D-6.

Cost and Returns Assumptions per Acre for Sugarcane

	NWFP	Punjab	Sind
Yield (MDS)	435	432	398
kg	16266	16154	14883
N (kg)	41.9	25.8	31
P (kg)	8	8	9.5
Price/kg	.23	.23	.23
Labor (hours)			
Jan	120	86	86
Feb	115	82	85
Mar	95	90	94
Apr	65	64	44
May	5.4	34.5	3.2
Jun	5.7	6.5	9
Jul	3.4	3.5	37
Aug	3.4	3	3.2
Sep	23.4	3	3.2
Oct	54	1.5	3.2
Nov	107	80	89
Dec	125	85	84
Total	722.3	539	540.8
Land (AC)			
Jan	1	1	1
Feb	1	1	1
Mar	1	1	1
Apr	1	1	1
May	1	1	1
Jun	1	1	1
Jul	1	1	1
Aug	1	1	1
Sep	1	1	1
Oct	1	1	1
Nov	1	1	1
Dec	1	1	1
Total	12	12	12
Water (AF)	3.84	3.4	5.2
Seed (SR)	1536	1585	1975
Forage (MDS)	139	135	149
kg	5191	5041	5564
Revenue	3741	3715	3423
'VAR' Cost	829	700	830
Net Revenue	2912	3016	2593

APPENDIX TABLE B-7.

Cost and Returns Assumptions per Acre for Berseem

	NWFP	Punjab	Sind
Yield (MDS)		471	380
kg	0	17613	14210
N (kg)		11	6
P (kg)		2.1	2
Price/kg		0	0
Labor (hours)			
Jan		31	28
Feb		35	22
Mar		37	22
Apr		25	16
May		19	3
Jun			
Jul			
Aug			
Sep		2	6
Oct		12	13
Nov		19	17
Dec		28	24
Total	0	208	151
Land (AC)			
Jan		1	1
Feb		1	1
Mar		1	1
Apr		1	1
May		1	.2
Jun			
Jul			
Aug			
Sep		.1	.6
Oct		1	1
Nov		1	1
Dec		1	1
Total	0	8.1	7.8
Water (AF)		2.4	2.5
Seed (SR)		2.1	7
Forage (MDS)		141	114
kg	0	5266	4257
Revenue	0	0	0
'VAR' Cost	0	140	155
Net Revenue	0	-140	-155

APPENDIX TABLE B-8.

Cost and Returns Assumptions per Acre for Grass

	NWFP	Punjab	Sind
Yield (MDS)	2.9	5.1	6
kg	108	191	224
N (kg)	1	3	0
P (kg)	0	0	0
Price/kg	5	5	5
Labor (hours)			
Jan	3.4	.8	1.7
Feb			
Mar		21	22
Apr	23.2		4
May			
Jun			
Jul			
Aug			
Sep	8.9	3.4	.5
Oct	18	5.1	6
Nov		3.8	7
Dec		2	1
Total	53.5	36.1	42.2
Land (AC)			
Jan	1	1	1
Feb	1	1	1
Mar	1	1	.5
Apr			
May			
Jun			
Jul			
Aug			
Sep	.5	.2	.1
Oct	1	.6	.6
Nov	1	1	1
Dec	1	1	1
Total	6.5	5.8	5.2
Water (AF)	.5	.7	.7
Seed (SR)	10	10	33
Forage (MDS)	6.8	8.3	9
kg	254	310	336
Revenue	542	954	1122
'VAR' Cost	45	61	98
Net Revenue	497	893	1024

APPENDIX TABLE B-9.

Cost and Returns per Acre for Soybeans

	NWFP	Punjab	Sind
Yield (MDS)	12	12	
kg	449	449	0
Oil %	17.57	17.57	17.57
Oil kg	79	79	0
Cake/Meal %	79.66	79.66	79.66
Cake/Meal kg	357	357	0
N (kg)	12	12	
P (kg)	5	5	
Price/kg	3.05	3.05	3.05
Labor (hours)			
Jan			
Feb			
Mar			
Apr			
May			
Jun			
Jul	40	35	
Aug	15	15	
Sep	12	12	
Oct	45	42	
Nov			
Dec			
Total	112	104	0
Land (AC)			
Jan			
Feb			
Mar			
Apr			
May			
Jun			
Jul	1	1	
Aug	1	1	
Sep	1	1	
Oct	1	1	
Nov			
Dec			
Total	4	4	0
Water (AF)	1.1	1.2	
Seed (SR)	30	30	
Forage (MDS)	70	70	
kg	2614	2614	0
Revenue	1369	1369	0
'VAR' Cost	730	758	0
Net Revenue	638	610	0

APPENDIX TABLE B-10.

Cost and Returns per Acre for Sunflower

	NWFP	Punjab	Sind
Yield (MDS)	12	12	14
kg	449	449	524
Oil %	38.9	38.9	38.9
Oil kg	175	175	204
Cake/Meal %	30.37	30.37	30.37
Cake/Meal kg	136	136	159
N (kg)	20	20	25
P (kg)	8	8	10
Price/kg	3.5	3.5	3.5
Labor (hours)			
Jan			
Feb	38		
Mar	16		
Apr	11		
May	40		
Jun			
Jul		38	38
Aug		16	16
Sep		11	11
Oct		40	40
Nov			
Dec			
Total	105	105	105
Land (AC)	1.7	1.7	2.1
Jan			
Feb	1		
Mar	1		
Apr	1		
May	1		
Jun			
Jul		1	1
Aug		1	1
Sep		1	1
Oct		1	1
Nov			
Dec			
Total	4	4	4
Water (AF)	1.75	1.75	2.1
Seed (SR)	6	6	6
Forage (MDS)	50	50	50
kg	1867	1867	1867
Revenue	1571	1571	1832
'VAR' Cost	322	322	370
Net Revenue	1249	1249	1462

APPENDIX TABLE B-11.

Cost and Returns per Acre for Safflower

	NWFP	Punjab	Sind
Yield (MDS)			6
kg	0	0	224
Oil %	32	32	32
Oil kg	0	0	72
Cake/Meal %	65	65	65
Cake/Meal kg	0	0	146
N (kg)			20
P (kg)			10
Price/kg	3	3	3
Labor (hours)			
Jan			5
Feb			2
Mar			3
Apr			4
May			30
Jun			30
Jul			
Aug			
Sep			
Oct			
Nov			6
Dec			20
Total			100
Land (AC)			
Jan			1
Feb			1
Mar			1
Apr			1
May			1
Jun			.5
Jul			
Aug			
Sep			
Oct			
Nov			.5
Dec			1
Total	0	0	7
Water (AF)			0
Seed (SR)			7
Forage (MDS)			0
kg	0	0	0
Revenue	0	0	673
'VAR' Cost	0	0	311
Net Revenue	0	0	362

APPENDIX C-1

Linear Programming Basic Tableau for HWFP

	1 OIL	2 REAL	3 POUL	4 MILK	5 JANH	6 FEBH	7 MARH	8 APRH	9 MAYH	10 JUNH	11 JULH	12 AUGH	13 SEPH	14 OCTH	15 NOVH
	------1,000 MT--------				----------1,000 HOURS----------										
1 JANL	----	----	----	----	-1	----	----	----	----	----	----	----	----	----	----
2 FEBL	----	----	----	----	----	-1	----	----	----	----	----	----	----	----	----
3 MARL	----	----	----	----	----	----	-1	----	----	----	----	----	----	----	----
4 APRL	----	----	----	----	----	----	----	-1	----	----	----	----	----	----	----
5 MAYL	----	----	----	----	----	----	----	----	-1	----	----	----	----	----	----
6 JUNL	----	----	----	----	----	----	----	----	----	-1	----	----	----	----	----
7 JULL	----	----	----	----	----	----	----	----	----	----	-1	----	----	----	----
8 AUGL	----	----	----	----	----	----	----	----	----	----	----	-1	----	----	----
9 SEPL	----	----	----	----	----	----	----	----	----	----	----	----	-1	----	----
10 OCTL	----	----	----	----	----	----	----	----	----	----	----	----	----	-1	----
11 NOVL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-1
12 DECL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
13 JANA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
14 FEBA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
15 MARA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
16 APRA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
17 MAYA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
18 JUNA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
19 JULA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
20 AUGA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
21 SEPA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
22 OCTA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
23 NOVA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
24 DECA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
25 FORA	----	----	----	4	----	----	----	----	----	----	----	----	----	----	----
26 MEAL	----	-1	.3	.4	----	----	----	----	----	----	----	----	----	----	----
27 OIL	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----
28 MAIZT	----	----	.6	----	----	----	----	----	----	----	----	----	----	----	----
29 WHEAT	----	----	.6	----	----	----	----	----	----	----	----	----	----	----	----
30 MAIZR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
31 MURPR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
32 WHETR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
33 SUGCR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
34 GRAMR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
35 PRICE	4.4	-1.04	7	1.2	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002

Continued. . .

'PRICE,' the Objective Function, is in Rs Millions.
Positive RHS Values Denote <= Restrictions, Otherwise,>= Conditions Apply.

Appendix C-1
(Continued)

	16 DECH	17 MAIZ	18 MARP	19 WHEA	20 SUGC	21 GRAM	22 SUNF	23 SOYB	24 RHS
	------	----------1,000 ACRES----------							
1 JANL	----	----	----	5.8	120	3.4	----	----	67344
2 FEBL	----	----	----	3.7	115	----	38	----	67344
3 MARL	----	----	----	3.7	95	----	16	----	67344
4 APRL	----	----	----	55.3	65	23.2	11	----	67344
5 MAYL	----	----	----	10.8	5.4	----	40	----	67344
6 JUNL	----	43.4	----	----	5.7	----	----	----	67344
7 JULL	----	38.6	8.9	----	3.4	----	----	40	67344
8 AUGL	----	.7	10.5	----	3.4	----	----	15	67344
9 SEPL	----	2.7	18	----	23.4	8.9	----	12	67344
10 OCTL	----	46.1	14.6	4.1	54	18	----	45	67344
11 NOVL	----	----	23	9.7	107	----	----	----	67344
12 DECL	-1	-1	23	3.7	125	----	----	----	67344
13 JANA	----	----	----	1	1	1	----	----	736
14 FEBA	----	----	----	1	1	1	1	----	736
15 MARA	----	----	----	1	1	1	1	----	736
16 APRA	----	----	----	1	1	----	1	----	736
17 MAYA	----	----	----	----	1	----	----	----	736
18 JUNA	----	1	----	----	1	----	----	----	736
19 JULA	----	1	1	----	1	----	----	1	736
20 AUGA	----	1	1	----	1	----	----	1	736
21 SEPA	----	1	1	----	1	.5	----	1	736
22 OCTA	----	1	1	.5	1	1	----	1	736
23 NOVA	----	----	1	1	1	1	----	----	736
24 DECA	----	----	1	1	1	1	----	----	736
25 FORA	----	-1.2	-.08	-1.6	-5.2	-.25	-1.9	-2.6	0
26 MEAL	----	----	-.13	----	----	----	-.14	-.36	0
27 OIL	----	----	-.21	----	----	----	-.18	-.08	0
28 MAIZT	----	-.67	----	----	----	----	----	----	0
29 WHEAT	----	----	----	-.48	----	----	----	----	0
30 MAIZR	----	1	----	----	----	----	----	----	335
31 MARPR	----	----	1	----	----	----	----	----	5
32 WHETR	----	----	----	-1	----	----	----	----	-317
33 SUGCR	----	----	----	----	-1	----	----	----	-200
34 GRAPR	----	----	----	----	----	-1	----	----	-1
35 PRICE	-.002	.0955	.0552	.0445	.2912	.0497	.1249	.0638	

'PRICE,' the objective function, is in Rs Millions.
Positive RHS Values Denote <= Restrictions, Otherwise,>= Conditions Apply.

APPENDIX C-2

Linear Programming Basic Tableau for Project

	1 OIL	2 MEAL	3 POUL	4 MILK	5 JANH	6 FEBH	7 MARH	8 APRH	9 MAYH	10 JUNH	11 JULH	12 AUGH	13 SEPH	14 OCTH	15 NOVH
	1,000 MT				1,000 HOURS										
1 JANL	----	----	----	----	-1	----	----	----	----	----	----	----	----	----	----
2 FEBL	----	----	----	----	----	-1	----	----	----	----	----	----	----	----	----
3 MARL	----	----	----	----	----	----	-1	----	----	----	----	----	----	----	----
4 APRL	----	----	----	----	----	----	----	-1	----	----	----	----	----	----	----
5 MAYL	----	----	----	----	----	----	----	----	-1	----	----	----	----	----	----
6 JUNL	----	----	----	----	----	----	----	----	----	-1	----	----	----	----	----
7 JULL	----	----	----	----	----	----	----	----	----	----	-1	----	----	----	----
8 AUGL	----	----	----	----	----	----	----	----	----	----	----	-1	----	----	----
9 SEPL	----	----	----	----	----	----	----	----	----	----	----	----	-1	----	----
10 OCTL	----	----	----	----	----	----	----	----	----	----	----	----	----	-1	----
11 NOVL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-1
12 DECL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
13 JANA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
14 FEBA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
15 MARA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
16 APRA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
17 MAYA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
18 JUNA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
19 JULA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
20 AUGA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
21 SEPA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
22 OCTA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
23 NOVA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
24 DECA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
25 FORA	----	----	----	4	----	----	----	----	----	----	----	----	----	----	----
26 MEAL	----	-1	.3	.4	----	----	----	----	----	----	----	----	----	----	----
27 OIL	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----
28 MAIZT	----	----	.6	----	----	----	----	----	----	----	----	----	----	----	----
29 WHEAT	----	----	.6	----	----	----	----	----	----	----	----	----	----	----	----
30 MAIZR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
31 WHAPR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
32 WHETR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
33 SUGCR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
34 GRAMR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
35 COTN	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
36 LINV	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
37 RICR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
38 BERR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
39 PRICE	4.4	1.04	7	1.2	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002

Continued . . .

'PRICE,' the Objective Function, is in Rs Millions.
Positive RHS Values Denote <= Restrictions, Otherwise,)= Conditions Apply.

Appendix C-2
(continued)

	16 DECH	17 MAIZ	18 MURP	19 WHEA	20 SUGC	21 GRAM	22 SUNH	23 MUSS	24 COTT	25 RICE	26 BERS	27 SOYB	28 RHS
	-----	-----	-----	-----	-----	-----	-----	1,000 ACRES	-----	-----	-----	-----	
1 JANL	----	----	22.7	4.4	66	.8	----	----	----	----	31	----	1110224
2 FEBL	----	----	13.5	3.9	52	----	--38	----	----	----	35	----	1110224
3 MARL	----	----	11	3.7	90	21	14	----	----	----	37	----	1110224
4 APRL	----	----	----	52.7	64	----	11	----	10.1	----	25	----	1110224
5 MAYL	----	----	----	19.2	34.5	----	40	----	8.4	----	19	----	1110224
6 JUNL	----	2.3	----	----	6.5	----	----	35	20.2	30.1	----	----	1110224
7 JULL	----	8.3	----	----	3.5	----	----	16	2.5	98.6	----	35	1110224
8 AUGL	----	44.2	----	----	3	----	----	11	6.9	40.5	----	15	1110224
9 SEPL	----	2.5	1.5	----	3	3.4	----	40	12.0	6.9	2	12	1110224
10 OCTL	----	25	3.8	2.1	1.5	5.1	----	----	43.6	5.7	12	42	1110224
11 NOVL	----	25	3.1	14.6	60	3.0	----	----	55.6	47.2	19	----	1110224
12 DECL	-1	----	10.9	3.9	85	2	----	----	23.6	20.1	20	----	1110224
13 JANA	----	----	1	1	1	1	----	----	----	----	1	----	22150
14 FEBA	----	----	1	1	1	1	1	----	----	----	1	----	22150
15 MARA	----	----	.85	1	1	1	1	----	----	----	1	----	22150
16 APRA	----	----	----	1	1	----	1	----	.3	----	1	----	22150
17 MAYA	----	----	----	----	1	----	1	----	1	----	1	----	22150
18 JUNA	----	1	----	----	1	----	----	----	1	1	----	----	22150
19 JULA	----	1	----	----	1	----	----	1	1	1	----	1	22150
20 AUGA	----	1	----	----	1	----	----	1	1	1	----	1	22150
21 SEPA	----	1	.2	----	1	.2	----	1	1	1	.1	1	22150
22 OCTA	----	1	1	.1	1	.6	----	1	1	1	1	1	22150
23 NOVA	----	1	1	1	1	1	----	----	1	1	1	----	22150
24 DECA	----	----	1	1	1	1	----	----	.85	1	1	----	22150
25 FORA	----	-1.1	-.1	-1.0	-5	-.3	-1.9	-1.9	-2.7	-3	-3.1	-2.6	0
26 MEAL	----	----	-.149	----	----	----	-.136	-.136	-.21	----	----	-.357	0
27 OIL	----	----	-.243	----	----	----	-.175	-.175	-.028	----	----	-.079	0
28 MAIZT	----	-.56	----	----	----	----	----	----	----	----	----	----	0
29 WHEAT	----	----	----	-.68	----	----	----	----	----	----	----	----	0
30 MAIZR	----	1	----	----	----	----	----	----	----	----	----	----	1220
31 MURPR	----	----	1	----	----	----	----	----	----	----	----	----	543
32 WHETR	----	----	----	-1	----	----	----	----	----	----	----	----	-9920
33 SUGCR	----	----	----	----	-1	----	----	----	----	----	----	----	-1642
34 GRAMR	----	----	----	----	----	-1	----	----	----	----	----	----	-526
35 COTR	----	----	----	----	----	----	----	----	-1	----	----	----	-3662
36 LINT	----	----	----	----	----	----	----	----	-.127	----	----	----	-1
37 RICR	----	----	----	----	----	----	----	----	----	-1	----	----	-3091
38 BERR	----	----	----	----	----	----	----	----	----	----	1	----	3000
39 PRICE	-.002	.0599	.0649	.0711	.3	.0893	.1249	.1249	.0232	.066	-.014	.061	

'PRICE,' the Objective Function, is in Rs Millions.
Positive RHS Values Denote <= Restrictions, Otherwise,>= Conditions Apply.

APPENDIX C-3

Linear Programming Basic Tableau for Sind

	1 OIL	2 MEAL	3 POUL	4 MILK	5 JANH	6 FEBH	7 MARH	8 APRH	9 MAYH	10 JUNH	11 JULH	12 AUGH	13 SEPH	14 OCTH	15 NOVH
	------1,000 MT--------				----------					----------1,000 HOURS----------					
1 JANL	----	----	----	----	-1	----	----	----	----	----	----	----	----	----	----
2 FEBL	----	----	----	----	----	-1	----	----	----	----	----	----	----	----	----
3 MARL	----	----	----	----	----	----	-1	----	----	----	----	----	----	----	----
4 APRL	----	----	----	----	----	----	----	-1	----	----	----	----	----	----	----
5 MAYL	----	----	----	----	----	----	----	----	-1	----	----	----	----	----	----
6 JUNL	----	----	----	----	----	----	----	----	----	-1	----	----	----	----	----
7 JULL	----	----	----	----	----	----	----	----	----	----	-1	----	----	----	----
8 AUGL	----	----	----	----	----	----	----	----	----	----	----	-1	----	----	----
9 SEPL	----	----	----	----	----	----	----	----	----	----	----	----	-1	----	----
10 OCTL	----	----	----	----	----	----	----	----	----	----	----	----	----	-1	----
11 NOVL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-1
12 DECL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
13 JANA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
14 FEBA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
15 MARA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
16 APRA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
17 MAYA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
18 JUNA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
19 JULA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
20 AUGA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
21 SEPA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
22 OCTA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
23 NOVA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
24 DECA	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
25 FORA	----	----	----	4	----	----	----	----	----	----	----	----	----	----	----
26 MEAL	----	-1	.3	.4	----	----	----	----	----	----	----	----	----	----	----
27 OIL	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----
28 MAIZT	----	----	.6	----	----	----	----	----	----	----	----	----	----	----	----
29 WHEAT	----	----	.6	----	----	----	----	----	----	----	----	----	----	----	----
30 MAIZR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
31 MURPR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
32 WHETR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
33 SUGCR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
34 GRAMR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
35 COTR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
36 LIWT	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
37 RICR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
38 BERR	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
39 PRICE	4.4	-1.04	7	1.2	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002	-.002

Continued. . .

'PRICE,' the Objective Function, is in Rs Millions.
Positive RHS Values Denote <= Restrictions, Otherwise,>= Conditions Apply.

	16 DECH	17 MAIZ	18 MURP	19 WHES	20 SUSC	21 GRAM	22 COTT	23 RICE	24 BERG	25 SUNF	26 SAFF	27 RHS
	----	----	----	----	----	1,000	ACRES	----	----	----	----	
1 JANL	----	----	20.6	3.2	86	1.7	----	----	28	----	5	373690
2 FEBL	----	----	13.8	3.2	85	----	----	----	22	----	2	373690
3 MARL	----	----	1.5	16.4	94	22	----	----	22	----	3	373690
4 APRL	----	----	----	14.7	44	4	14.5	3.4	16	----	4	373690
5 MAYL	----	1.5	----	19.2	3.2	----	13.9	17.8	3	----	30	373690
6 JUNL	----	4.2	----	----	9	----	7	16.9	----	----	30	373690
7 JULL	----	3.7	----	----	37	----	2	17.4	----	38	----	373690
8 AUGL	----	3	----	----	3.2	----	2	30.1	----	16	----	373690
9 SEPL	----	3	8.5	----	3.2	.5	36.1	18.5	6	11	----	373690
10 OCTL	----	3	3.1	----	3.2	6	79.3	21.6	13	40	----	373690
11 NOVL	----	50	1.5	10.7	93	7	----	23.8	17	----	6	373690
12 DECL	-1	----	14.5	3.2	84	1	----	3.5	24	----	20	373690
13 JANA	----	----	1	1	1	1	----	----	1	----	1	7443
14 FEBA	----	----	1	1	1	1	----	----	1	----	1	7443
15 MARA	----	----	.65	1	1	.5	----	----	1	----	1	7443
16 APRA	----	----	----	.25	1	----	.55	.1	1	----	1	7443
17 MAYA	----	.25	----	----	1	----	1	.9	.2	----	1	7443
18 JUNA	----	75	----	----	1	----	1	1	----	----	.5	7443
19 JULA	----	1	----	----	1	----	1	1	----	1	----	7443
20 AUGA	----	1	----	----	1	----	1	1	----	1	----	7443
21 SEPA	----	1	.2	----	1	----	1	1	.6	1	----	7443
22 OCTA	----	1	1	----	1	.6	1	1	1	1	----	7443
23 NOVA	----	.5	1	1	1	1	----	1	1	----	.5	7443
24 DECA	----	----	1	1	1	1	----	1	1	----	1	7443
25 FORA	----	-.672	-.093	-1.7	-5.56	-.336	-2.5	-3.16	-4.2	-1.87	----	0
26 MEAI	----	----	-.149	----	----	----	-.264	----	----	-.159	-.146	0
27 OIL	----	----	-.243	----	----	----	-.035	----	----	-.204	-.072	0
28 MAIZT	----	-.262	----	----	----	----	----	----	----	----	----	0
29 WHEAT	----	----	----	-.763	----	----	----	----	----	----	----	0
30 MAIZR	----	1	----	----	----	----	----	----	----	----	----	263
31 MURPR	----	----	1	----	----	----	----	----	----	----	----	249
32 WHETR	----	----	----	-1	----	----	----	----	----	----	----	-2146
33 SUGCR	----	----	----	----	-1	----	----	----	----	----	----	-228
34 GRAMR	----	----	----	----	----	-1	----	----	----	----	----	-788
35 COTR	----	----	----	----	----	----	-1	----	----	----	----	1256
36 LINT	----	----	----	----	----	----	-.161	----	----	----	----	-1
37 RICR	----	----	----	----	----	----	----	-1	----	----	----	2157
38 BERR	----	----	----	----	----	----	----	----	1	----	----	1023
39 PRICE	-.002	.0107	.0662	.0812	.2593	.1	.0226	.994	-.016	.1462	.0362	

'PRICE,' the Objective Function, is in Rs Millions.
Positive RHS Values Denote <= Restrictions, Otherwise,>= Conditions Apply.

APPENDIX TABLE D-1

Cost of U.S. Soybean Meal at Karachi, 3/7/83

U.S. $1 = Rs 12.5	
C&F value at U.S. $240/MT	3000
2 percent import licence fee for C&F value	60
1 percent landing charges on C&F	30
1 percent insurance on C&F + landing charges	30
10 percent duty on CFIL	312
10 percent sales tax on duty paid value	331
5 percent surcharge on C&F value	150
Clearing and forwarding charges	13
Stevedoring	65
Empty bags (16 bags/ton at Rs 9/bag)	144
Bagging labor	16
Transportation--dock to warehouse	46
Warehouse offloading and stacking labor	22
Miscellaneous expenses	15
Handling shrinkage (.5 percent)	21
TOTAL In-Country Cost	4255
	(U.S. $340)
Up-country trucking (10 tons/truck)	
Karachi-Hazara	640
Lahore-Hazara	250
Karachi-Lahore	400

India bagged meal C&F value is estimated to be U.S. $235 (Rs 2938). India meal would save Rs 144 (bag cost) and bagging labor cost. Estimated India in-country cost is Rs 4022 (U.S. $322).

Data are courtesy of Arbor Acres/Pak Soya Feeds Ltd.

A SIMULATION MODEL OF ALTERNATIVE PRICING POLICIES IN THE PAKISTANI EDIBLE OIL COMPLEX: A POLICY ANALYSIS

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May 1, 1983

INTRODUCTION

The current rapid increase in Pakistani imported edible oil demand is primarily due to inappropriate pricing policy. The primary objective of this paper is to advance an alternative pricing policy and simulate some of its critical attributes that will be of interest to policy makers.

The first section describes the major edible oils pricing and marketing problems. The second section presents an alternative edible oils pricing policy and discusses its potential contribution to easing the current severe drain on Pakistan's foreign exchange account. The third section presents a simulation model demonstrating and analyzing the alternative policy. The fourth section presents the model's results and evaluates their implications for future edible oilseed development programs in Pakistan.

It is important to note that economic policies attempt to resolve conflicts between two or more factions within a society. The operational policies are often the result of considerable pragmatism and consensus methods of decision making. These aspects of policy evolution are immensely useful approaches and can be even more fruitful when combined with systematic simulations of policy changes. The results of the following analysis should not be interpreted as the definitive solution to a very serious problem. Rather, the findings should be tested with common sense in the policy arena and used or modified as necessary to contribute to an improved edible oils policy.

THE POLICY PROBLEM

The edible oils complex presents one of the most serious economic problems facing the GOP because it constitutes one of Pakistan's largest and most rapidly rising foreign exchange costs. Since the country has enough land to support substantially more oil production and a deteriorating balance of payments, the failure to reduce edible oil import costs, either absolutely or as a rate of growth, is an enigma.

International oil prices are presented lower than domestic production costs, but the government has not moved to erect effective protective tariffs. The price situation is ironic because the government also held farm prices low in the 1970s when international oil prices were much higher than domestic ones. This missed opportunity has been costly because it induced massive stagnation in domestic oilseed production programs and created an even more inefficient oil processing sector.

Now, the GOP must weigh the consequences of the present policy against dramatic initiatives to stimulate domestic production and reduce the edible oil foreign exchange cost. Most of the present

edible oils policy is now implemented by the Ghee Corporation of Pakistan (GCP). The GCP imports most oil, buys most domestic cottonseed and sunflower oil and operates an oilseed promotion and procurement program. Partly because it is a government monopoly, GCP labor productivity is less than half that of private sector ghee plants. The GCP's main function is industrial--the production of vegetable ghee--yet it also attempts to promote increased oilseed production. Oilseed crop yields and acreages remain low due to low expected farm prices which are largely the result of the GCP's unreliable seed procurement practices. The prospects for increasing domestic oil production are extremely poor unless the GCP's monopoly position as an oilseed buyer are eliminated through strong competition by many oilseed processors, oil refiners and attendant brokers.

Even if all ghee plants were suddenly denationalized and the GCP abolished, major structural problems would still restrict the market. During the past decade the GOP consistently held vegetable ghee price increases below the inflation rate for most other goods. More specifically, the vegetable ghee price has been essentially constant since 1979/80. If the GOP were to have allowed vegetable ghee prices to rise with the general consumer price index since 1979/80, the present price level would be approximately Rs 14.4 per kg instead of the present price of Rs 10.7 per kg. If vegetable ghee prices were to have risen at the same rate as the consumer price index for food during the past four years, the present price would be about Rs 14.7 per kg. Since vegetable ghee prices were tightly controlled throughout most of the last decade, the present price of vegetable ghee, adjusted for inflation, would be considerably higher than Rs 15 per kg.

Another indication of serious retail market price constraints is found in a comparison of vegetable ghee prices of India with those of Pakistan. Recent prices in India have been reported between Rs (Pakistan) 15 and 18 per kg. This striking price disparity between neighboring countries raises the strong possibility of smugglers exporting relatively cheap Pakistani oil to India at considerable profit. It also could be argued that Pakistani consumers enjoy considerable price benefits compared with those in India; but conversely, Pakistan's farmers are distinctly disadvantaged (discouraged) in oilseed production.

Pakistan's economy abounds with government-induced price distortions in all sectors, so any discussion of oilseed comparative advantage will be complicated by these incalculable distortions. The GOP has made increased wheat production one of its highest agricultural priorities; yet a simple U.S.-Pakistan comparison of wheat and sunflower yields raises a few doubts about the efficacy of that policy.

Assuming typical wheat and sunflower yields per acre of 1091 kg and 500 kg, respectively, in the U.S., and 681 kg and 270 kg in Punjab Province, the U.S. has an absolute advantage in both wheat and sunflower production but a comparative advantage in sunflower

production. This is because one acre in the U.S will produce 85 percent more sunflower seed but only 60 percent more wheat than an acre in Pakistan. The assumed Pakistani yields represent extraordinary government support for wheat and virtually no support for sunflower. If the GOP only were to adopt a policy to remove oilseed marketing barriers and allow edible oil prices to float toward the border price (eliminating sunflower subsidies), the Punjab sunflower yield would rise to at least 449 kg and the U.S. comparative advantage would switch to wheat. The U.S. would produce 60 percent more wheat per acre, but only 11 percent more sunflower seed per acre.

AN ALTERNATIVE EDIBLE OILS PRICING POLICY

The large foreign exchange costs of imported oil can be reduced significantly by implementing the following policy:

1. The retail price of vegetable ghee should be allowed to immediately float upward to Rs 15 per kg and thereafter move in concert with the fundamental market forces of supply and demand.

2. Any GOP agency or any private firm should be free to import oil and sell it to any domestic refinery at a uniform price.

3. Any firm desiring to crush oilseeds, refine oilseeds, refine oil, or broker these products should be free to do so without the restrictions of regulations designed to encourage monopoly and/or monopsony conditions.

4. All oil importers should sell their oil to refiners at a price that is the new retail vegetable ghee price (at least Rs 15 per kg on a 16 kg can basis), minus the sum of the current vegetable ghee processing margin (approximately Rs 3.4 per kg), a vegetable ghee tax (12.5 percent of the retail vegetable ghee price) and a normal importer's margin. The difference between the importer's selling and purchasing prices should be taxed as an import tariff.

5. The GOP would maintain the current domestic crude oil price of Rs 250 per maund (Rs 6.7 per kg) as a support floor price, but refiners would be allowed to purchase domestic oil at any higher price that permitted a reasonable return at the retail vegetable ghee price.

6. Liquid cooking oil prices would be free to float up to the retail vegetable ghee price. Its lower margin (Rs 2.4 per kg) and the vegetable ghee tax would allow cooking oil prices to rise to no higher than Rs 12.1

per kg and still remain competitive with vegetable ghee while about Rs 2 above the present cooking oil price.

AN EDIBLE OILS PRICE POLICY SIMULATION MODEL

A simulation model has been designed to describe some of the major consequences of restructuring the Pakistani edible oils market. The model includes the following assumptions:

1. The key government edible oil policy control device is the import oil sale price (F.O.B.) charged by oil importers to all domestic refiners.

2. The retail vegetable ghee price is Rs 3.4 per kg (refining margin) above the import oil price, plus a vegetable ghee tax of 12.5 percent of the retail price and a normal oil importing margin.

3. The price elasticity of vegetable ghee and industrial edible oil demand is -0.4, and the elasticity of liquid cooking oil demand with respect to the retail vegetable ghee price is 1.5.

4. The improved pricing policy will stimulate future domestic oil production increases mainly in sunflower where the supply elasticity with respect to the retail vegetable ghee price will be 1.5.

5. The improved pricing policy will induce increased labor productivity in the oilseed processing and edible oil refining sectors.

6. Imported oil requirements will be the difference between total oil consumption and total domestic production.

7. The foreign exchange cost will be Rs 5,100 per metric ton of imported oil.

8. The GOP will collect the difference between the shipboard price and the importer's sale price as an excise tax.

9. Any change in the present retail price of vegetable ghee (in response to a change in the import oil cost to refiners) would cause instantaneous changes throughout the edible oil complex according to the above assumptions.

SIMULATION MODEL RESULTS

Two simulations are presented in this paper, although many other possible modifications may be demonstrated. Table 1 presents the hypothetical effects of raising the retail vegetable ghee price higher than the present price of Rs 10.7 per kg. The simulated results for all alternative prices are based on respective differentials between the "new" price and the "NOW" situation represented by the assumed values of the first column. In the "NOW" situation, the GOP production costs are estimated to be Rs 11.4 per kg of vegetable ghee.

At all alternative vegetable ghee prices the model assumes vigorous competition between the GOP and many other oil processors, eliminating the need for the present GOP subsidies. The model's simulation results are therefore linear in production and consumption for all prices above Rs 10.7. The discontinuity between Rs 10.7 and Rs 11 is due to the present subsidy requirement because the retail price is set too low.

The model predicts that a 40 percent increase in the retail price of vegetable ghee to Rs 15 per kg during 1982/83 would have led to:

- a 6 percent decrease in total oil consumption;
- a 16 percent decrease in vegetable ghee consumption;
- a 61 percent increase in cooking oil consumption;
- a 60 percent increase in domestic oil production
- a 19 percent increase in oilseed cake/meal production;
- a 16 percent increase in oilseed crop land;
- a 6 percent increase in edible oils labor requirements;
- a 41 percent decrease in both imported oil requirements and foreign exchange costs;
- a 66 percent increase in net farm income from oilseeds; and
- a 43 percent increase in GOP revenues directly from the edible oil sector.

Graphs of the effects of alternative import oil costs on consumption, production, foreign exchange cost and edible oil sector revenue are presented in Figures 1-4, respectively. These results portray dramatic changes in the edible oil sector that would have occurred if the imported price of oil had been raised

TABLE 1

Effects of Alternative Pricing Policies
on the Pakistan Edible Oil Complex, 1982/83

	NOW	Alternative Retail Vegetable Ghee Prices											
		-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-	-21-	21.07
Retail ghee (Rs/Kg)	10.7												
Import oil sale price (Rs/MT)	6700	6225	7100	7975	8250	9725	10600	11475	12350	13225	14100	14975	15033
Total consumption (1,000 MT)	851	857	845	833	820	808	796	784	771	759	747	734	734
V.G. consumption (1,000 MT)	689	681	656	630	604	578	522	527	501	475	449	424	422
C.O. consumption (1,000 MT)	112	117	132	148	164	180	195	211	227	242	258	274	275
IND. consumption (1,000 MT)	60	59	57	55	53	50	48	46	44	41	39	37	37
Oil production (1,000 MT)	299	312	353	395	437	479	521	563	605	647	689	731	734
Oilseed meal and cake (1,000 MT)	734	744	776	809	841	874	907	939	972	1004	1037	1069	1072
Million hectares of crop land	2.67	2.70	2.80	2.89	2.99	3.09	3.18	3.28	3.38	3.47	3.57	3.67	3.67
Labor (1,000 man years)	544	524	537	549	562	574	587	600	612	625	637	650	651
Imported oil (1,000 MT)	562	546	492	437	383	329	275	220	166	112	58	4	0
	Million Rs												
Foreign exchange cost	2866	2783	2507	2230	1954	1677	1401	1124	848	571	295	18	0
Net farm income	1943	2032	2331	2629	2928	3227	3525	3824	4122	4421	4720	5018	5038
Total GOP revenue	1821	1551	1966	2281	2494	2605	2616	2525	2332	2039	1644	[illegible]	[illegible]
Excise tax on ghee	922	937	983	1023	1057	1084	1105	1119	1127	1129	1124	[illegible]	1111
GOP oil import net revenue	899	614	983	1257	1437	1521	1511	1405	1205	910	520	35	0

NOTES:

(a) Totals may not sum due to rounding.
(b) Retail vegetable ghee is based on a 16 kg can.
(c) "Import oil sale price" is price set by the GOP which all importers charge to all domestic refineries.
(d) The support price for domestic oil is assumed to be Rs 6,700/MT (Rs 250/maund).
(e) "V.G." is vegetable ghee.
(f) "C.O." is cooking oil.
(g) "IND." is industrial.
(h) Additional domestic oil production beyond "NOW" situation is in sunflower equivalents.
(i) "Foreign exchange cost" assumes all imported oil is paid in hard currency.
(j) "Net farm income" is estimated returns to land, labor, capital and management from oilseed production.
(k) "Excise tax on ghee" is 12.5 percent of retail ghee price.
(l) "GOP oil import net revenue" is difference between "import oil price" and assumed border price of Rs 5,100/MT.

Figure 1
Simulated Total Oil Consumption, 1982/83

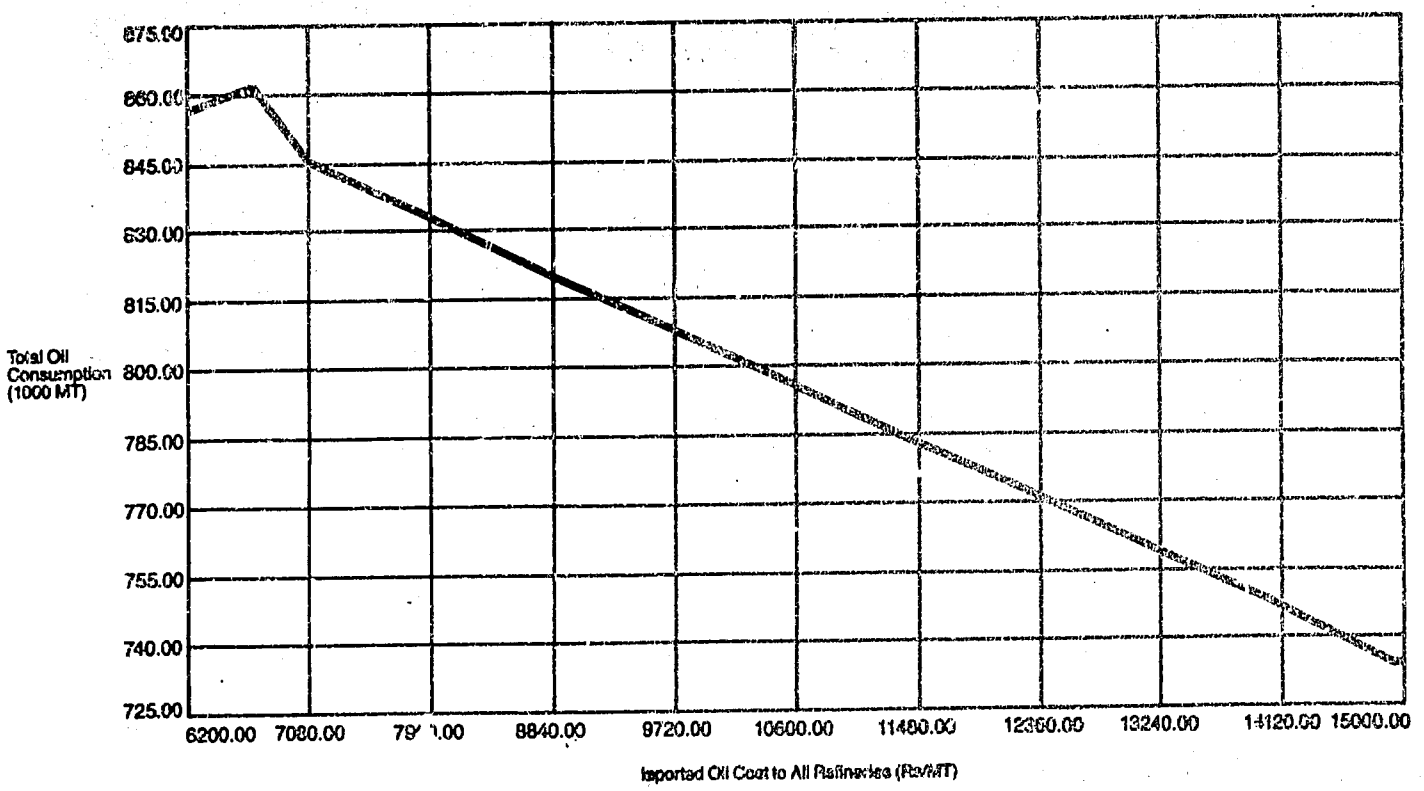


Figure 2
Simulated Oil Production, 1982/83

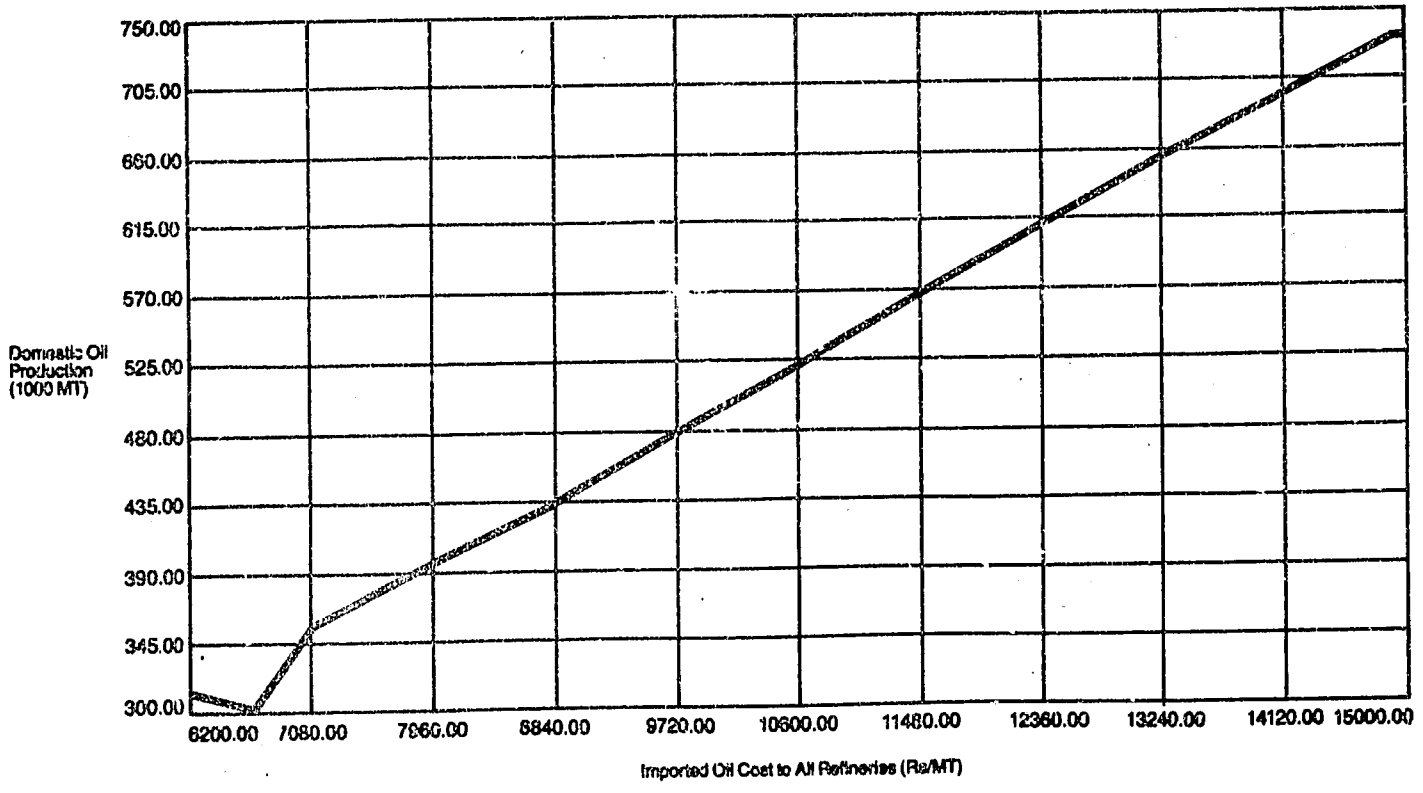


Figure 3
Simulated Foreign Exchange Cost, 1982/83

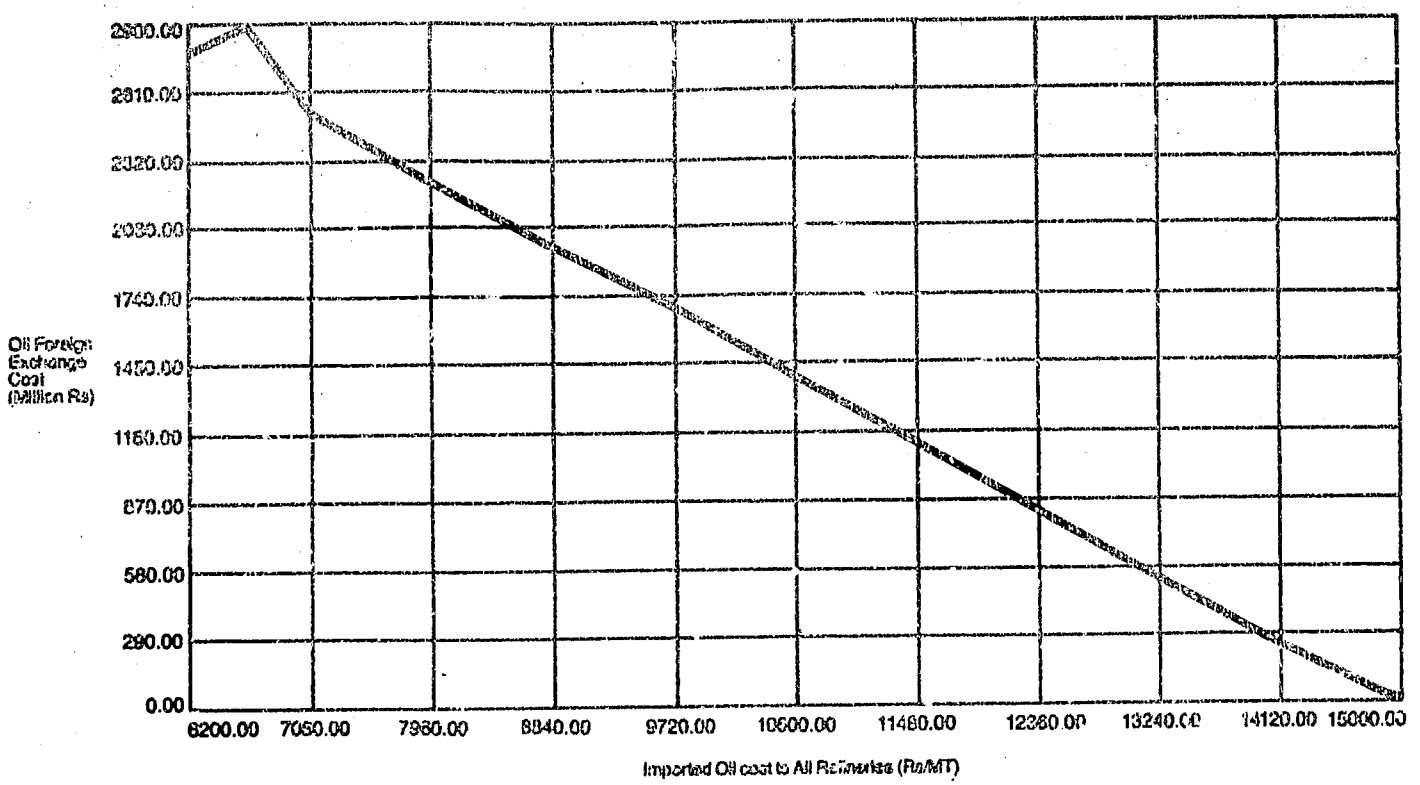
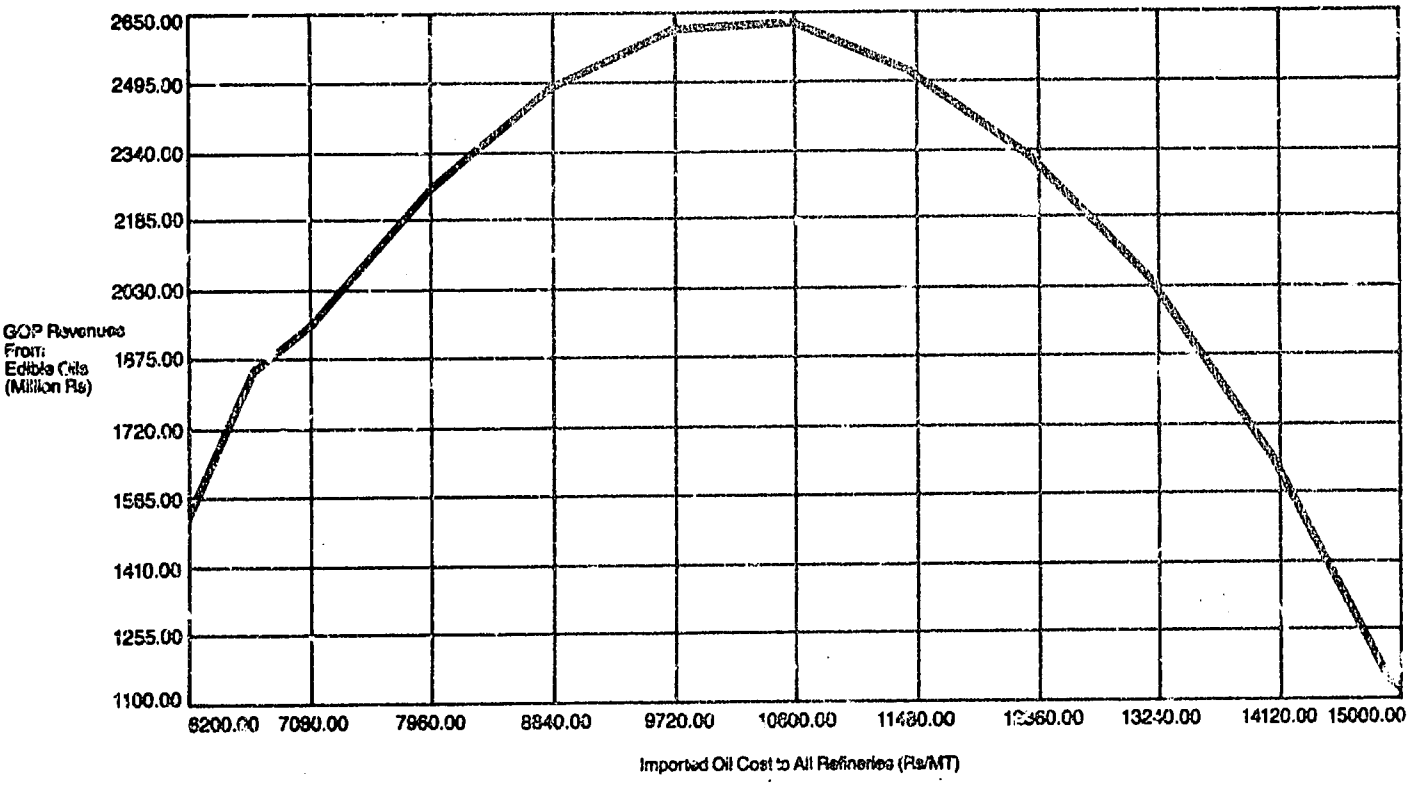


Figure 4
Simulated GOP Revenue, 1982/83



to approximately Rs 9,725 per metric ton, which would have induced a retail vegetable ghee price of about Rs 15 per kg. However, this model has a number of limitations that should be recognized. First, a 60 percent increase in domestic oil production is quite plausible, but it would require up to three years for the agricultural sector to restructure itself in response to the new pricing policy. Farm production response would quickly move toward the model's predicted production level after the first year as the effects of the farmer learning curves begin to accumulate. During this three-year adjustment process consumer real income would increase and therefore raise consumption levels slightly above the model's predicted levels.

The assumptions about the shift toward increasing the cooking oil proportion of edible oils consumption are probably conservative. Since the model does not specify cooking oil prices it presumes that cooking oil prices would lag behind vegetable ghee price increases. If consumers were to shift toward cooking oil at a greater rate, there would be less pressure on vegetable ghee demand to push its price to Rs 15 and proportionately greater incentives for increased domestic oil production.

Finally, if the retail vegetable ghee price actually were to rise to the vicinity of its estimated real/border price (Rs 15) in 1982/83, the current inflation rate of 6.3 percent would drive the price to about Rs 18 in 1985/86.

If the GOP were to make no policy changes during the next three years, it would face a truly desperate situation. Table 2 presents a simulation in the same context as that of Table 1, except that "NOW" is 1985/86 and consumption has risen by 10.9 percent per annum since 1982/83 while the retail vegetable ghee price has remained at Rs 10.7 per kg and domestic oil production has risen by only 2.6 percent per annum since 1982/83. The same evaluations can be made on Table 2, except that the estimated real/border price of vegetable ghee has risen to Rs 18.

A layout of the simulation model as a spreadsheet was prepared with the microcomputer software package, *Supercalc*, and is on file with USAID/ARD/Pakistan. The spreadsheet model can be used for further testing of alternative policies and econometric assumptions.

TABLE 2

Effects of Alternative Pricing Policies
on the Pakistan Edible Oil Complex, 1985/86

	NOW-	-11-	-12-	-13-	-14-	-15-	-16--	-17--	-18--	-19--	-20--	-21--	24.43
		----------Alternative Retail Vegetable Ghee Prices----------											
Retail ghee (Rs/Kg)	10.7												
Import oil sale price (Rs/MT)	6700	6225	7100	7975	8850	9725	10600	11475	12350	13225	14100	14975	17976
Total consumption (1,000 MT)	1175	1170	1153	1136	1120	1103	1086	1069	1053	1036	1019	1002	945
V.G. consumption (1,000 MT)	960	929	894	859	824	789	754	719	683	648	613	578	458
C.O. consumption (1,000 MT)	153	159	181	202	224	245	267	288	310	331	352	374	447
IND. consumption (1,000 MT)	82	81	78	75	72	69	66	63	60	57	53	50	40
Oil production (1,000 MT)	323	337	382	427	472	518	563	608	654	699	744	789	945
Oilseed meal and cake (1,000 MT)	802	813	848	883	918	953	988	1024	1059	1094	1129	1164	1285
Million hectares of crop land	2.88	2.91	3.02	3.12	3.23	3.33	3.44	3.54	3.64	3.75	3.85	3.96	4.32
Labor (1,000 man years)	594	567	580	594	607	621	635	648	662	675	689	702	749
Imported oil (1,000 MT)	852	833	771	709	647	585	523	461	399	337	275	213	0
	----------Million Rs----------												
Foreign exchange cost	4345	4250	3934	3618	3301	2985	2668	2352	2036	1719	1403	1086	9
Net farm income	2095	2192	2515	2837	3160	3482	3805	4128	4450	4773	5095	5418	6524
Total GOP revenue	2620	2216	2884	3435	3869	4186	4385	4467	4431	4279	4008	3621	1397
Excise tax on ghee	1257	1278	1341	1396	1442	1479	1508	1527	1538	1540	1533	1517	1397
GOP oil import net revenue	1363	938	1543	2039	2427	2707	2878	2940	2894	2739	2475	2104	0

NOTES:

(a) Totals may not sum due to rounding.
(b) Retail vegetable ghee is based on a 16 kg can.
(c) "Import oil sale price" is price set by the GOP which all importers charge to all domestic refineries.
(d) The support price for domestic oil is assumed to be Rs 6,700/MT (Rs 250/maund).
(e) "V.G." is vegetable ghee.
(f) "C.O." is cooking oil.
(g) "IND." is industrial.
(h) Additional domestic oil production beyond "NOW" situation is in sunflower equivalents.
(i) "Foreign exchange cost" assumes all imported oil is paid in hard currency.
(j) "Net farm income" is estimated returns to land, labor, capital and management from oilseed production.
(k) "Excise tax on ghee" is 12.5 percent of retail ghee price.
(l) "GOP oil import net revenue" is difference between "import oil price" and assumed border price of Rs 5,100/MT.

AGRICULTURAL PRODUCTION CONTRACTING IN PAKISTAN: A CASE STUDY IN AGRIBUSINESS INNOVATION

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I. INTRODUCTION

A. Marketing Constraints in Agriculture

1.1 Pakistan's agricultural development is hampered by serious marketing inefficiencies. Government price controls and subsidy schemes have led to distortions in the pricing of foodstuffs. The mechanisms that link farm production to final consumer food demand continue to pose one of the major constraints to improved agricultural performance.

1.2 Extreme price variability discourages farmers from taking the necessary risks to adopt new technologies and adjust their supply to price movement in international markets. Much of agricultural price variability is due to weather factors. Price instability also arises when marketing institutions fail to provide procedures to communicate efficiently with adequate price information or to make adequate investments in market infrastructure.

1.3 Pakistan's farmers and consumers make production and consumption decisions that are appropriate for their individual circumstances, but often fall short of the market's potential. Farmers' production decisions are generally conservative because they face great risks in the marketplace. Without assurance of a known selling price at planting time, farmers have little incentive to expand production. Market middlemen also face great uncertainties due to wide variability in food processing losses, production mobility and equally great fluctuation in retail food prices.

B. Marketing Institutions

1.4 A wide variety of marketing institutions serve the Pakistan farm community. These can be divided into the traditional market (mandi), the unorganized market, the state sector and agribusiness. The traditional market is centered in regulated markets where the farmer sells his crop through a commission agent. The commission agent provides credit to the farmer and directs the auctioning of the crops. In the unregulated market, intermediaries (beoparis) buy farmers' crops and sell them in various markets. There is a wide range of traders that buy directly from farmers, either before or after harvest. The state sector serves as a buffer to the private and unregulated markets by procuring essential commodities at fixed prices and stockpiling goods for use during periods of shortage.

1.5 Pakistani agribusiness processing firms contribute to increased market efficiency by vertically integrating produce procurement with their plants' processing operations. When company procurement agents buy produce at the farmgate, farmers have

increased certainty about the expected sale price and quantity. Farm-to-processing plant transportation eliminates intermediate transportation from the farm to a wholesale market and therefore reduces unit transportation costs. Farm-to-plant transportation also reduces produce waste and spoilage. Processing plants are operating more efficiently when they buy directly from farmers because the delivery schedules can be better coordinated to minimize raw produce inventory at the plants, yet keep the plants operating near their engineered capacities. These procurement operations also make an important contribution to maket grading standards by signaling to all farmers the exact raw produce quality standards that it enforces through its buying and receiving agents.

1.6 By comparison to the other marketing institutions, agribusinesses represent only a small part of the total market for foodstuffs. In the early 1970's, the activities of private agribusinesses were greatly restricted under the Bhutto administration's nationalization and land reform programs. Since that time, there has been a partial recovery of the private agribusiness sector, yet many of the government marketing institutions created or expanded during the Bhutto period remain in operation.

C. The Innovation and Diffusion of Agricultural Technology

1.7 One of the main prerequisites of rapid innovation and diffusion of new technology is a marketing system that clears information efficiently and provides producers with a sense of security that encourages risk-taking. The conventional innovation and diffusion model predicts individual and group adoption of new technologies as an S-shaped function of time. In the early stages of innovation, the most progressive farmers experiment with a new technology and make the modifications necessary to realize a profit. Less progressive farmers watch their progressive neighbors' results and quickly follow with their own cautious experiments once they have evidence that other farmers have been successful. In the late stages of the adoption process, the least progressive, more risk adverse farmers begin adopting the new technology after most of their neighbors have become adopters.

1.8 Several Pakistan agribusiness firms have implemented a contracting arrangement with farmers that offers hope of improving the environment for innovation and diffusion of new technologies. These firms issue written contracts that guarantee to purchase farmers' production under conditions that offer increased income security. The contracts appear to improve market stability and therefore add to the inducements necessary to attract farmers to new technologies. As a study of institutional innovation, these production contracting operations offer an example of a technology transfer and support.

D. Objectives of this Study

1.9 This study was designed to assess the contributions of several Pakistan agribusinesses' production contracting operations to improved agricultural marketing performance and induced agricultural innovation. Specific objectives were:

1. Describe and compare selected agribusiness production contracting operations.

2. Assess the impact of selected agribusinesses on farm innovation.

3. Assess the applicability of the agribusiness model to the Pakistan edible oil sectors.

4. Assess the implications of production contracts for donor assistance to Pakistan.

II. SURVEY METHODOLOGY

2.1 In August and September of 1983, a survey was conducted of four leading agribusiness firms and eighty-one cultivators who supply produce to two of these firms. The companies under investigation were selected on the basis of their reputation as an industry leader and as a progressive innovator in the agribusiness field. The four companies selected are: (1) Rafhan Maize Products Co., Ltd., (2) the Baba Farid Sugar Mills Ltd., (3) Mitchells Fruit Farms Ltd. and (4) the Pakistan Tobacco Company Limited. The first three of these firms are based in the interior of the Punjab within the Okara and Renala Khurd districts. The fourth firm, the Pakistan Tobacco Co., is located in Nowshera in the Northwest Frontier Province. All of the firms selected provide marketing contracts to the growers.

2.2 Eighty-one farmers who sell their produce to Rafhan and the Baba Farid Mill were interviewed. Thirty maize growers who had production contracts with Rafhan Maize Products Ltd. and ten non-contract maize growers in the Okara region were interviewed. Twenty fully-supervised sugarcane contractors and twenty-one non-supervised contractors who sell their produce to the Baba Farid Mills were interviewed. With the assistance of industry representatives, the farm households were located.*

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*Attempts to stratify the sample by size of landholding or experience with the firm proved infeasible.

2.3 Company representatives were asked to summarize the activities of their firm, focusing especially on the package of support services and marketing assistance they provide to the growers. This included a history of their contracting and support service experience: their credit, extension, marketing and dispute arbitration practices and the production performance of their growers. A copy of the industry survey questionnaire is provided in Appendix 1.

2.4 The farmers were grouped by the level of support they receive from the firm and were questioned about their production practices, performance and relationship with the agro-industry. The survey included questions on farm innovation, the quality and utility of support services, the sources of technical information to the grower, costs and returns of the crop sold to the agribusiness and the yield history of the crop. A copy of the farm level questionnaire is provided in Appendix 2.

2.5 Although a sample survey was the method used to draw information from the farm community, the primary objective of this investigation is to provide a case study of four leading agribusiness firms and to explore their role in agricultural innovation. A sample of four firms is too small on which to draw broad conclusions about the nature of the agribusiness sector in Pakistan. However, it does allow for a description of the role these enterprises can play in agricultural development. By choosing leading representatives of the agribusiness community, the performance and impact of these firms can be examined.

III. CASE STUDY RESULTS

A. Company Descriptions

3.1 The Rafhan Maize Products Co., Ltd., of Faisalabad, initiated a maize production campaign in 1970. The company is jointly held by the multinational firm CPC International and the Rafhan Maize Co. With the help of CPC, Rafhan initiated a hybrid seed program and catalyzed the growth of the maize industry in the interior of the Punjab.

3.2 The Rafhan hybrid program was initiated because of the failure of the Punjab Ministry of Agriculture to establish a viable maize breeding program. With the assistance of CIMMYT and CPC, Rafhan began a breeding program using imported USDA maize lines. In the first year of its breeding program, the company sought out large farmers and the military farm to try the experimental varieties. The first few years of the breeding program were difficult as yields were irregular and because the company was obliged to compensate farmers when their crop failed. After

a few years of adaptive research on farmers' fields the crop yields improved. By the mid-1970's approximately 800 farmers in the region were growing maize under contract to Rafhan and many more were using the improved varieties. To ensure an adequate supply of spring maize and to promote the utilization of hybrid seeds and improved inputs, Rafhan has continued its policy of contracting with a select group of farmers. The maize that is contracted for accounts for approximately 20 percent of Rafhan's processing volume with the remainder obtained from local markets.

I. Agro-Industry Fact Sheet:

Rafhan Maize Products Co., Ltd., Faisalabad, Punjab

1. **Commodity procured:** corn

2. **Products produced:** starch, dextrose, glucose, jellies, jams, custard and ice cream powders, gelatin, corn oil, cattle and poultry gluten feed.

3. **Plant capacity:** 75,000 to 80,000 tons of maize per year.

4. **Contract farmers:** average 500 to 800 depending on plant requirements; they supply nearly 20 percent of processing capacity.

5. **Support staff:** production division headed by a PhD agronomist with three MS-level agronomists in three field offices, plus two seed officers.

6. **Support services:** technical advice provided on all phases of cultivation for contract farmers. Hybrid seed delivered to the farm; fertilizer, insecticide and herbicide supplied by company's commission agent.

   The company advances an interest free loan to farmers for purchase of inputs. The company rents tillage equipment to the growers and conducts its own crop research trials. The cost of company supplied inputs is deducted from the grower's receipt at the time of payment.

7. **Crop procurement:** the company provides free transport to the factory for full eight ton loads. The ratio of the difference between a full load and the farmer's cargo times the shipping cost, is borne by the grower. The company supplies bags and pays the loading and bag-sewing charges.

8. **Marketing practices:** the crop is weighed at the factory and purchase supervisors screen for moisture and damage. Electronic weighing and moisture testing is conducted and penalties are assessed for extra-moisture or mold and insect damage.

9. **Payment procedures:** payment is made within ten days of weighing. A demand deposit is personally delivered by the agronomist to the contract grower.

10. **Contracting procedure:** contracts are signed before planting. Price based on prevailing market rates plus a Rs. 5/md premium. One guarantor required on each contract. In cases of environmental calamity, repayment of loans is deferred one season.

3.3 Under the written contracts, the growers are guaranteed a fixed price for all the maize that is produced. The company provides the farmer with seed, fertilizer and pesticide. The cost of these inputs is deducted from the payment after the crop is delivered to the mill. The company provides free technical assistance, haulage service, packing facilities and also rents tillage equipment to the growers. In return, the growers must agree to use the company's hybrid seeds and apply the recommended amounts of fertilizer and pesticide.

3.4 The Rafhan plant has a capacity of 75,000 to 80,000 tons of maize per year and produces several corn products including starch, glucose, vegetable oil and animal feeds. The production division of the firm is divided into three geographical zones which come under the direction of an agronomist based in Faisalabad. Each zone has a field office headed by a MS-level agronomist and procurement center headed by a procurement officer. The ratio of contract farmers to field agronomist varies from year to year but has not exceeded three hundred to one. The company enforces quality standards for moisture and disease, and uses both electronic moisture testing and electronic weigning facilities. Payment is made promptly after crop delivery in the form of a check or a demand deposit, and in the case of the contract farmers, is delivered directly to their residence.

3.5 The Baba Farid Sugar Mills Ltd., in Okara, is owned by the FECTO group and was brought into operation in November of 1980. The firm was sanctioned by the GOP in 1976 and Okara was chosen as the site for the mill. Previously, Okara had been a major cotton producing area, but due to problems of water logging and soil salinity the cropping pattern had to be changed from cotton to cane. The plant has a capacity of 400,000 tons of cane per year. In 1981/1982, 325,000 metric tons were crushed and in 1982/1983, 240,000 tons were crushed.

3.6 The Cane Commissioner of the Punjab has assigned the Baba Farid Mills a procurement zone of 25 miles encircling Okara. Within that zone all sugarcane growers are required to sell at least 80 percent of their output to the mill and the mill is required to buy all the cane that is produced at the government set procurement price. The Baba Farid Company contracts with 14,000 growers within its zone and also buys cane from an estimated 700 growers each year who reside outside the mill's zone.

3.7 Of their 14,000 contracted growers, roughly 70 percent produce under non-supervised conditions. These growers sign a procurement contract which guarantees them a fixed price for their produce and assigns them a delivery date for their crop. These contracts are signed shortly before the harvest and serve

to regulate the flow of crops into the mill. The growers may deliver their produce to the mill or to a procurement center with the company deducting a transport charge for produce hauled from a procurement center to the mill.

II. Agro-Industry Fact Sheet:

Baba Farid Sugar Mills, Ltd., Okara, Punjab

1. **Commodity procured:** sugar cane

2. **Products produced:** refined sugar, molasses, by-products

3. **Plant capacity:** 400,000 MT of cane per season

4. **Contract farmers:** approximately 14,000, 30 percent fully supervised.

5. **Total farmers:** 14,700

6. **Support staff:** 10 senior staff supervise production in 10 zones with a support staff of 100 technicians.

7. **Support services:** supervision/advice is offered on cultivation practices via farm visits and village group meetings. Recommendations are made on seed, fertilizer, herbicide and insecticide use. For fully supervised growers, production loans are arranged through two commercial banks and the ADBP. Plus the company delivers seed at the planting season.

8. **Crop procurement:** scheduled by company field office to ensure a smooth supply of cane to the mill.

9. **Marketing practices:** 40 percent of farmers bring cane to purchase centers. Company charges up to Rs. 1.4/md for transport to factory, depending on distance. Full price of Rs. 9.64/md paid for factory-gate delivery and a minimum of Rs. 8.25/md paid at the purchase centers. No quality factors are utilized. The cane is bought by weight and the factory is obligated to crush all cane offered by farmers within their zone.

10. **Payment procedure:** factory weight receipt used to prepare bank draft. A demand deposit is sent directly to the farmer's bank account.

11. **Contracting procedure:** Procurement contracts signed at least a month before harvest. Procurement price is fixed by the GOP, presently at Rs. 9.64/md. Two guarantors are required for each farmer who has not demonstrated reliability. In case of crop failure due to bad weather, the banks will defer repayment of production loans, but interest continues to accumulate.

3.8 The sugar mill arranges credit from the Agricultural Development Bank and from two commercial banks for the production requirements of the fully supervised growers. The fully supervised grower decides on an annual acreage allotment for sugarcane, whereupon the firm arranges a loan for the recommended allotment of seed, fertilizer and pesticide. For the very small

growers, these loans are interest free. For others, the interest rate is 13 percent per annum. The company has divided its procurement zone into ten sub-zones, each headed by a MS-level agronomist or an experienced cane cultivator. Within each zone there are 10 to 15 field agents who extend technical advice to the cultivators. The ratio of field agents to fully supervised growers is one to thirty. Only those cultivators with more than five acres of sugarcane land are eligible to be fully supervised by the firm and these individuals are provided with advice on all phases of cane cultivation. Credit arranged by the firm for the fully supervised cultivators increased from a total of three million rupees in 1980/81 to seven million rupees in 1981/82 and is slated to reach 12 million rupees by 1982/83.

3.9 The Mitchells Fruit Farms Ltd., of Renala Khurd, was founded in 1920 by F.J. Mitchell. The firm was incorporated in 1933 and consisted of a 750 acre citrus plantation and a small processing factory. During the 1972 Land Reform, 500 acres of the company's land was confiscated. By that time, the Mitchell family held only a five percent interest in the firm. Fifteen percent was held by the Cadbury-Schweppes firm of Great Britain and the remainder was held by a group of Pakistani shareholders. Starting in 1981, the firm began to produce a variety of confectionary goods which by 1983 accounted for 50 percent of the gross sales of the firm. In addition to the confectionary goods, the firm produces 60 assorted processed fruit and vegetable items for distribution through branch offices in Renala Khurd, Lahore, Karachi and Rawalpindi. These include a variety of juices, jellies, jams, squashes, ketchups, preserves, soup and canned vegetables.

3.10 To supplement the produce grown on the farm, Mitchells issues production contracts and purchases from several fruit and vegetable markets. Thirty-five to 40 farmers are contracted each year by Mitchells to supply produce and these farmers are scattered throughout the Punjab and the Sind. Several of their contract growers have a financial interest in the firm. The contracts allow for procurement from a specified area at a fixed price. The price is set to allow for a slight premium over market rates. Quality specifications are detailed in the contract. The grower is required to cultivate the crop and deliver it to Mitchells. The firm does not have a production outreach program that extends beyond the boundaries of their own farm. Quality standards are rigidly enforced by the firm and all produce not meeting those standards is rejected.

III. Agro-Industry Fact Sheet:

Mitchells Fruit Farms Ltd., Renala Khurd, District Okara, Punjab

1. **Commodities procured:** Several fruits and vegetables including oranges, limes, lemons, mangos, guavas, grapefruit, apricots, tomatoes, peppers, carrots, corn, peas, chillies, onions, plums.

2. **Products produced:** 17 types of confectionary, 5 kinds of fruit drink, 5 kinds of fruit syrup, 2 types of vinegar, 12 kinds of jellies and jam, ketchup, 5 types of relish, 2 types of preserves, 3 kinds of tomato paste, 2 types of soup and 7 varieties of canned vegetables.

3. **Plant capacity:** process 850 tons of tomatoes, 50 tons of peas, 26 tons of onions, 3 tons of chillies, 62 tons of sweet corn, 515 tons of oranges, 80 tons of grapefruit, 106 tons of apples, 40 tons of lemons, 14 tons of plums, 45 tons of guavas, 320 tons of mangos, and 25 tons of apricots (1982 estimates). Tomatoes, corn, mangoes, 10 percent of the lemons and half the oranges are grown under contract. 90 percent of the lemons, half the oranges and all the limes are grown on own fields. Other crops are purchased from the green markets (subzi mandi).

4. **Contract farmers:** 35-40 throughout Punjab and Sind.

5. **Support staff:** farm production staff includes trained agronomists; do not do outreach but concentrate on production on Mitchells' 240 acre fruit farm.

6. **Support services:** sweet corn seed is supplied by the company to contractors. No other goods or services provided.

7. **Crop procurement:** delivery date scheduled by firm.

8. **Marketing practices:** farmer arranges delivery of crop. Crop is inspected according to standards such as color, ripeness, disease or others as specified in the contract. Any item not meeting the quality standards is rejected and either returned to the farmer or sold on his behalf in the local market. After inspection the crop is weighed and a receipt issued.

9. **Payment practices:** immediate payment at time of weighing in the form of a bank draft or cash.

10. **Contracting procedures:** in citrus, quantity and price closed bids are solicited from a list of preferred growers one to two months before the harvest. For vegetable production, contracts based on area allotments are prepared several months before the planting season. For vegetables, a small premium is paid over the market price. When market prices rise and are greater than the contract price, renegotiation procedures are allowed. Both written and verbal contracts are used. A surety deposit is required on certain advance contracts.

3.11 The Pakistan Tobacco Company in Nowshera, NWFP, is a majority owned subsidiary of the British American Tobacco Company of London. The Pakistan Tobacco Company initiated the cultivation of Virginia tobaccos and the manufacture of cigarettes in Pakistan. In 1948 the company started its contracting program with growers on a 20 acre plantation. In 1951 the company installed the country's first redrying plant in Akora Khattak and

in 1958 a cleaning and classifying plant was installed. A more modern cleaning and classifying machine was installed in 1962 which, in addition to increased redrying capacity, allows for a processing capacity of approximately 7,000 kgs. per hour.

3.12 The company has been involved in the dissemination of tobacco varieties throughout the Frontier and has been involved in an extensive outreach and research program. At present, there are three areas where the company is trying to introduce tobacco cultivation. These are Mansehra, Swat and Batta Gram. In the early years farmers in these regions were given free seed, fertilizer and pesticide and a guaranteed market for their crop. In addition, their crop was lifted at prices that would be unattractive to any competing firm. As the farmers became more accustomed to cultivating tobacco, subsidies on fertilizer were lifted, although seed and pesticide are still distributed for free. In addition, the company also provided subsidies for new barn construction and for the purchase of tractors. In Batta Gram, tobacco has been successfully substituted for poppy, improving both the company's market and the safety and security of the region as a whole. Throughout the company's operations in the Punjab and NWFP, subsidies are provided for free seed and limited subsidies are granted for reforestation and new barn construction. Research is conducted on new varieties, improved drying techniques and better processing methods. In conjunction with the Pakistan Tobacco Board, research and demonstration outreach is conducted.

3.13 The company works closely with its parent corporation and also with the Pakistan Tobacco Board. The parent firm, BAT, has been a source of new technology, annual seed stock and training facilities. The Tobacco Board has unified the marketing process; arranged for major annual loans for the companies; established a price floor and grower grievance committees; and has established its own research and extension network. The Tobacco Board, building upon the contract used by the Pakistan Tobacco Company, has also mandated the use of a uniform marketing contract.

3.14 The Pakistan Tobacco Company contracts primarily with the smaller grower, reflecting the predominance of small cultivators in tobacco production. In 1978, 82 percent of the growers that sold tobacco to the company had one drying barn which can account for an area of approximately three acres of cropland. In 1983, 88 percent of all the growers that sold flue-cured Virginia tobacco to the company had only one barn. The tendency towards greater small-holder production of tobacco is explained by the high labor intensity of cultivation and the importance of utilizing family labor in crop production. As labor costs are driven up by out-migration and seasonal shortages, the profitability of tobacco production becomes more dependent on the availability of own-family labor.

IV. Agro-Industry Fact Sheet:

Pakistan Tobacco Company, Mansehra, NWFP

1. **Commodity procured:** tobacco

2. **Products produced:** cigarettes, pipe tobacco

3. **Plant capacity:** 7,000 kgs per hour; 1981/82 processed 13.307 MT's of tobacco including 8.765 MT's of flue cured Virginia.

4. **Contract farmers:** approximately 5,000 growers under contract and 100 to 200 not under contract.

5. **Support staff:** 17 agricultural graduates and 8 promotees directing a field staff of 50 to 60 extension and procurement employees.

6. **Support services:** all cultivators receive free seed and a guaranteed market with pre-specified payment arrangements. In newly opened development areas, cultivators receive free seed, pesticide and fertilizer plus a guaranteed market. Subsidies were also provided for the purchase of tractors and for the adoption of appropriate production techniques such as topping and suckling. Company provides demonstration plots, extension outreach services and a field research program. Loans are now being arranged and supported by the company for new shed construction. Various reforestation programs are also underway.

7. **Crop procurement:** under regulation of the Pakistan Tobacco Board, the company specifies periods when the grower may bring bales of tobacco to the purchase center. Different grades are purchased at different times, starting from the lowest to the highest grade and each farmer is only allowed to bring a limited portion of his crop to the procurement center at one time. Company operates 16 buying premises.

8. **Marketing practices:** crop is weighed and graded at the purchase center. Farmer is entitled to reject the sale at the center and take his tobacco elsewhere. After the sale, the farmer is given a slip with his name, weight of the produce, grade of produce, purchase price and date he can claim payment. On that date the farmer provides the slip at a local bank and receives a cash payment. Farmer assumes all costs of delivering the crop to the purchase center.

9. **Payment procedures:** the delay between the sale of the crops to a purchase center and payment from a local bank is set on a sliding scale depending on the part of the purchase season in which the crop was sold. For example, those who sell their crop within the first week of the season are paid within one week, those in the second week are paid within two weeks, etc. This procedure is regulated by the Pakistan Tobacco Development Board.

10. **Contracting procedure:** a verbal commitment to contract is made between the company's representative and the cultivator by December and a list of contracts is submitted to the Pakistan Tobacco Board by the end of the year. Actual procurement contracts are signed in the first quarter of the following year.

B. Contracting and Farmer Support Procedures

3.15 Contracts between the companies and the growers serve as a formal guarantee that both sides to the agreement are willing to provide a specified set of goods and/or services to each

other. It is a most important device for formalizing and regulating the contact between the community of cultivators and the corporation. In Pakistan, as in many other parts of the developing world, the traditional form of contract is a verbal agreement witnessed by two or more observers. That form of binding agreement still predominates but is difficult, if not impossible, to administer when large corporate bodies must deal with thousands of contractees. However, the contract as such is largely a symbolic device. It implies that both parties to the agreement are willing to uphold their agreement; yet, in Pakistan it is more morally than legally binding. Only rarely do firms take cultivators to court for non-compliance with the contracts and then only for exceptional cases such as non-payment of several loans.* For the cultivator, the written contract is a relatively new institution. As it becomes more widely adopted, the farmer's sense of market security is heightened. The traditional agricultural markets (mandi's) and the State marketing operations (i.e., PASSCO, GCP and CEC) operate primarily on the basis of verbal agreements or verbal pronouncements with little protection against the hazards of market malpractice that accompany verbal contracting.

3.16 For the growers, contracting is a symbol of increased market security and is also a very real form of risk spreading. In all the cases examined in this study, the firms had a great deal of competition within their industry (e.g., tobacco, fruits and vegetables), from the traditional market (e.g., maize) or were under strict government price supervision (e.g., sugarcane). For growers, the contracts are a means of introducing a certain amount of order into the market without stifling competition. For the Pakistani cultivators, there are no crop insurance programs or futures markets which can be used to spread production risks and equalize farm cash flow. The company's contract, by assuring a market at a set price, does remove some of the risk faced by the cultivators.

3.17 The contracts used by the companies vary in depth, complexity and in enforceability. The most detailed contract used is that of the Rafhan Company which stipulates the set of production practices and inputs to be used, the amount of land to be sown with maize, the purchase price and several other procedural matters related to the granting of the loan by the company. On the other side of the spectrum is the short-form style of contract used by the Mitchell Farms Co. which provides only for the type of produce, grade and purchase price. All of

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*In the tobacco industry it is common for a cultivator to establish several contracts with different companies and then honor the one that will pay him the highest price. This practice is recognized by the companies and by the Tobacco Board but both consider it a normal part of fair competition in the market.

the firms except Mitchells use contracts written in Urdu. Formally the practice of contracting was done in the English language which limited their comprehension to a rather select group of growers. This has changed as the use of contracts has become more widespread. Copies of the contracts used by the four firms interviewed are in Appendix B.

3.18 Different agro-businesses offer a wide range of production support service to the growers. Both Rafhan and the Baba Farid Sugar Mills provide credit to the growers, deliver hybrid seed and arrange for the provision of inputs. They also provide a capable extension cadre to the growers. The major difference between the support services provided by these two firms is that Rafhan extends the production loans themselves with no interest charged and the sugar mill arranges the loans for the growers through a bank.* The Pakistan Tobacco Company supplies seeds and all physical inputs for free in the early phases of its development efforts. The company also subsidizes the delivery of seeds to all cultivators, new barn construction programs and the purchase of tractors. The Pakistan Tobacco Company also operates a research system and an extension and demonstration network. By comparison, Mitchell Farms offers practically no production support services. Growers are given advice from company agronomists at the factory premise, but otherwise there is no outreach program. This is a reflection of the high proportion of well-established farmers who have produced for many years for Mitchell's and the low percentage of processing capacity supplied under contract.

C. IMPACT OF CONTRACTS ON THE FARM COMMUNITY

C.1 Farmer Characteristics

3.19 The maize and sugarcane growers interviewed in this study operate far larger acreages than the typical farmer (Table 3.1). The 1972 Pakistan Census of Agriculture estimated the national typical farm size to be about 13 acres. Rafhan contract maize growers reported an average farm size over 10 times larger than the typical farm. Maize growers who do not contract with Rafhan reported farm sizes almost 3 times larger than the typical farm. Since about 95 percent of the sugarcane growers in the Baba Farid processing area have production contracts, they were classified according to whether they receive close technical supervision from Baba Farid agricultural agents. Supervised sugarcane growers reported an average farm size about 10 times

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*Arranging loans is itself a major production support service. The bureaucratic delays and red tape often inhibit the advancing of loans to all but the most cavelier of growers.

larger than the typical farm while unsupervised growers' average farm size is about 5 times larger than the typical farm.

3.20 About 80 percent of the interviewed maize and sugarcane growers' farmland is owned by the farmer-cultivator. In contrast, only about 39 percent of all farmland is owned by owner-cultivators, according to the 1972 Census of Agriculture.

3.21 The upward bias in farm size and ownership among interviewed maize and sugarcane growers represents both a survey bias and the processing firms' emphasis on larger, more progressive farmers. Because of the short time available to conduct this study, many farmers were located for interviewing by the firms' agricultural agents. The agents' emphasis on progressive farmers as role models for disseminating technical information makes the agents naturally inclined to showcase their larger, more successful farmer clients. Since private agribusiness firms are highly motivated to lower the administrative costs of technical assistance programs, there is a strong tendency to concentrate on larger farms where the output per agricultural agent will be greater.

C.2 Production Response

3.22 Rafhan contract maize growers have yields of at least 300 kg per acre larger than the typical Punjab maize yield. Interviewed maize farmers reported yields almost three times larger than the Punjab 1975-1979 average of 528 kg per acre. However, the survey bias toward larger, more progressive farmers suggests that yields of over 1000 kg per acre are unrealistic for the typical contract maize grower. Rafhan's aggregate yield statistics for 1973-1980 (Appendix D.2) report average yields of only 800 to 900 kg per acre, which is still significantly greater than the Punjab average yield. Contract maize growers' yields are slightly higher than non-contract gowers, but the difference is statistically insignificant (Appendix E).

3.23 Contract sugarcane growers for the Baba Farid Sugar Mills have potential yields at least double the typical Punjab sugarcane yield. Both supervised and unsupervised growers reported yields of about 30 tons per acre (Table 3.1). Again, the survey bias toward larger, more progressive farmers makes such yields largely unattainable by typical contract farmers. The Baba Farid mill serves about 14,000 farmers and, under normal growing conditions, should process at least 300,000 tons of cane annually. Baba Farid officials estimate that 34,000 acres of sugarcane are cultivated in the mill's procurement area. These production and processing statistics suggest that the average sugarcane yield in the Okara area is only about nine tons per acre, which would include considerable marginal production. The

Table 3.1
Characteristics of Farmers Interviewed

	Maize Growers		Sugarcane Growers	
	Contract	Noncontract	Supervised	Unsupervised
	N = 30	N = 10	N = 21	N = 20
Farm Size (acres)	162.7 (143.1)	36.2 (27.4)	133.6 (93.4)	76.3 (64.5)
Percent of Farm Owned	84.7 (16.0)	73.1 (26.6)	83.9 (26.8)	82.8 (27.1)
Years of Crop Experience	7.3 (5.3)	NA --	4.7 (5.7)	10.9 (11.9)
1982 Yield (100 kg)	15.1 (3.9)	13.0 (5.1)	323.2* (115.2)	318.7* (256.9)
1979/80 Yield (100 kg)	-- --	-- --	278.0** (135.6)	217.4** (74.4)
Acres in Crop 1982	54.7 (50.5)	5.2 (5.2)	24.9* (29.7)	10.8* (10.4)
Acres in Crop 1979/80	-- --	-- --	14.1** (15.8)	7.3** (6.6)
Percent of Farm in Crop, 1982	35.0 (17.1)	18.3 (16.0)	21.0 (17.7)	26.6 (28.0)
1982 Net Returns*** per Acre (Rs)	1626 (656)	1430 (1606)	3653 (2529)	2814 (1915)
Annual Rent per Acre (Rs)	1312 (550)	1010 (281)	1234 (465)	992 (365)

Standard deviations are in parentheses below the respective means.

*Sugarcane yields and acreages are averaged over Baba Farid Sugar Mill's first two seasons (1980/81 and 1981/82)

**Sugarcane yields and acreages are averaged over the last two seasons (1978/79 and 1979/80) prior to Baba Farid's opening.

***Net returns are calculated as gross returns minus variable production costs.

available data on the Baba Farid Sugar Mill do not allow a more specific yield estimate within the 9-30 ton range. Since the mill has completed only three processing seasons, the average yields of contract growers the last two seasons before the mill opened and the first two seasons of processing at the mill are noteworthy. The two-year average yield of supervised growers increased 16 percent to 32 tons after the mill began operation. Unsupervised growers reported yield increases of 47 percent to 32 tons during the same period. These reported yield increases are inconclusive evidence, but they suggest that the sugar mill's contracting/technical assistance program has contributed to higher production. A pooled cross section-time series regression model estimates that supervised growers average about 5400 kg per acre more than unsupervised growers and that difference is statistically significant (Appendix E).

3.24 It was not possible to determine the yields of contract tobacco growers dealing exclusively with the Pakistan Tobacco Company, but the scope of its technical assistance program strongly suggests that its farmers have higher yields than other farmers. The NWFP leads the country in tobacco area and yield. In 1980-81, the average national tobacco yield was 1567 kg per hectare, compared to an average NWFP yield of 1660 kg per hectare. The company provides free seed to all contract growers and offers advice on cultural practices that is far more comprehensive than the typical tobacco extension program.

3.25 Rafhan's contracted maize acreage increased fivefold between 1973 and 1980 (Appendix D.2). This dramatic increase provides strong evidence that the company's contracting program has gained widespread farmer acceptance. Although the number of contracting farmers increased about two and one-half times during 1973-1980, it is equally important to note that contracted acreage per farmer increased about 70 percent. Statistical analysis indicates that the surveyed farmers increased their maize acreage about 2.3 acres per year (Appendix E). The combined effects of increased contracted acreage and increased acreage per contract have resulted from high farmer confidence in the Rafhan contract program and represent the fundamental prerequisites for introducing a new crop or promoting the expansion of an existing crop.

3.26 Evidence of acreage effects of sugarcane contracting are inconclusive, although the interviewed farmers reported acreage increases of 77 percent (supervised) and 48 percent (unsupervised) at the end of the mill's first two years of operation. Data on Okara sugarcane acreages are not available for the 1978-1982 period, but discussions with sugarcane growers and company officials indicate that the contract program has increased farmers' sense of price and income security to the extent that they are accepting new risks by expanding acreage.

Statistical analysis indicates that surveyed growers increased their acreages about 0.33 acres per year (Appendix E).

C.3 Crop Costs and Returns

3.27 Progressive contract maize farmers in this survey reported average gross returns of about Rs 2830 per acre of maize and returns net of variable costs of about Rs 1626 per acre. This is an attractive return relative to, for example, wheat. Non-contract maize farmers reported variable costs of about Rs 1008 per acre and net returns of about Rs 1430. Both groups of farmers spent about 42 percent of gross returns on variable production costs. Both groups also estimated annual land rents to be about Rs 300 per acre less than fixed costs of maize production. A regression analysis of 1982 production found no significant difference between the net returns of contract and non-contract growers (Appendix E).

3.28 Progressive sugarcane, supervised contract growers in this survey reported gross returns of about Rs 7474 per acre of sugarcane and net returns of about Rs 3653 per acre. Unsupervised growers reported variable production costs of about Rs 4558 per acre and net returns of about Rs 2814 per acre. Variable production costs were about 51 percent of supervised growers' gross returns, but about 62 percent of unsupervised grower gross returns. Growers' net returns exceeded estimated annual land rents by at least Rs 2000 per acre. A regression analysis of 1982 production found no significant difference between the net returns of supervised and unsupervised growers (Appendix E).

3.29 The Pakistan Tobacco Company estimates that progressive flue-cured Virginia tobacco growers can expect gross returns of about Rs 18,500 per acre and variable production costs of about Rs 12,000 per acre. With a net return of about Rs 6,500 per acre, tobacco is one of Pakistan's most profitable crops, but it is highly labor intensive and requires investments in curing barns that are not needed for other crops.

C.4 Assimilation of Technological Innovation

3.32 Technical assistance specialists in maize, sugarcane, and tobacco are confident that a farmer growing his respective crops for the first time will successfully implement their recommendations within the first two or three crop seasons. Company agricultural agents report that successful technical assistance programs require companies to insure that each agent is furnished adequate transportation and assigned a specific geographic area of responsibility. Company extension agents assert that their assistance is assimilated more readily than in the case of the government extension programs because agribusiness companies

strive to maintain a relatively low farmer-agent ratio.

3.31 Company agricultural agents consciously implement extension training to maximize the demonstration effects on neighboring farmers. The spillover effects of company agents' assistance to supervised farmers probably exceeds the direct benefits to supervised farmers.

3.32 A pooled cross section-time series regression model found a time trend variable to be an insigifnicant predictor of yield response for both sugarcane and maize yields (Appendix E). Baba Farid has been operating only three years, so a micro-estimate of its impact on yield would be very unlikely. Rafhan has operated in the area for over a decade; therefore the major impact of the innovative effect probably occurred at least five years ago.

C.5 Crop Diversification

3.33 Maize and sugarcane farmers interviewed in this study reported that about one-fifth to one-third of their land was cultivated in the crop in question. In the Okara area, the major sources of competition for maize and sugarcane are rice, wheat, and vegetables, particularly potatoes.

3.34 Pakistan Tobacco Company officials estimate that the typical tobacco farmer in NWFP operated three to five acres and frequently devotes up to one-half of his land to tobacco. This relatively high specialization is a result of small farm sizes and the crop's high labor requirements. The company monitors the profitability of sugarcane, wheat and maize crops to assess current crop competition potential and recommend crop rotations that complement tobacco production.

C.6 Sources of Farmer Information

3.35 Most contract maize farmers get price information directly from the company. Rafhan attempts to offer prices that are slightly higher than local market prices. If there is a maize shortage, Rafhan will offer farmers a price higher than the guaranteed price in order to assure adequate processing stock.

3.36 Most non-contract maize farmers get price information from maize traders in local markets. In order to accurately assess price competition, these farmers often have to contact more than one trader. In contrast, farmers generally agree that Rafhan makes accurate quotes of local prices. Farmers' major complaints about Rafhan's pricing policy is that it lowers its purchasing price as the market price falls--a universal complaint

of all sellers.

3.37 Most sugarcane growers get price information from radios or newspapers. Prices are set by the government and heavily publicized prior to the crushing season.

3.38 Maize contract growers get cultivation information primarily from company representatives. Books, journals and other farmers were mentioned frequently, but there is almost no contact with government agricultural extension agents.

3.39 Non-contract farmers get cultivation information primarily from other farmers. A much higher proportion of non-contract farmers contact the government extension agent for information than do the contract farmers.

3.40 Sugarcane growers most frequently contact other farmers for cultivation information. They frequently consult books, journals and company representatives, but about one-third get cultivation information from government extension agents.

D. Advantages and Disadvantages of Contracting and Farmer Support

3.41 For the agribusiness firms interviewed, the major advantages from the contracting and farmer support programs included the regulation of commodity supply, higher yields, better quality crops and the provision of commodities during times of the year when it would otherwise be difficult to secure a supply. The disadvantages to the firms, or costs that must be borne, include the premium prices that are paid to contract growers, the credit advanced or arranged by the company, the cost of supporting a field staff and providing inputs and, in the case of the sugarcane mill, the cost of having to accept all produce brought to the mill gate. The companies are not forced to contract or operate production campaigns. In all cases, the firms calculate that the benefits of contracting, as measured in profits, far outweigh the costs.

3.42 The advantages of contracting and participating in company-sponsored production campaigns to the growers include having access to a secure market, being payed at a fixed time, receiving a good, set price, increasing their production, receiving loans, growing commerically, receiving honest weighment, receiving inputs and advice and, in the case of sugarcane, not having to bother to mill on the farm. The costs to the farm community included, in certain cases, difficult sale procedures, inadequate and poorly-timed input supplies, insufficient competition which was said to hold down prices, the use of interest

bearing loans, underweighing of the produce, restrictions on where commodities could be sold, high input costs and low prices paid by the companies.* Smaller farmers and those not under contract with the firms complained that the firms would only supply credit and give inputs to the larger growers and that their requests for contracts had been denied. Although there were selected complaints about the companies contracting and farmer support procedures, the vast majority of the growers appreciated the services supplied by the companies and, if anything, the major disadvantage cited was that the companies were not including enough cultivators in their programs.

IV. IMPLICATIONS FOR THE EDIBLE OILS SECTOR

4.1 Edible oil refining is controlled by a parastatal organization, the Ghee Corporation of Pakistan (GCP). The GCP procures edible oil from expeller plants and processes it into vegetable ghee. The GCP also promotes the development of new oilseed varieties, notably sunflower, by providing farmers with seed and guaranteeing them a price and market for their crop.

4.2 Throughout the last decade the gap between domestic ghee consumption and edible oil production has steadily increased. The production of nontraditional edible oils has remained a small-scale operation and the production of traditional edible oils has stagnated. Milling efficiency has continued to decline as more low-pressure expellers have entered the market, replacing the already limited use of solvent processing facilities.

4.3 Part of the responsibility for the malaise in the edible oils sector can be traced to the nature and performance of the Ghee Corporation. According to several farmers interviewed from October 1982, to October 1983, the GCP supplies a meager extension cadre, delivers poor quality seed, often does not lift the crops when promised, sets unrealistically low seed moisture standards, often pays farmers more than 30 days after lifting the

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*The average farmer in our sample would have preferred the company to supply him with all the needed inputs for free, harvest the crop, weigh it and pay him simultaneously at, of course, rates well above the prevailing market level. In the case of Rafhan, the company maintains a policy of sending the field agronomist on almost daily rounds to supply technical assistance to the growers. This is a service that many growers expressed appreciation for. However, several farmers complained that the Rafhan agronomist was not always in his office when they wanted to talk with him. In some cases, apparently, the best of extension campaigns is a no-win proposition.

crops and is not responsive to the demands of farmers for more formalized production contracting. Furthermore, the GCP work force at its plants is estimated to be nearly six times the private ghee plants' labor requirements for the same output. Profit maximization in extraction appears to be less important to the GCP than employment generation.

4.4 The institutional differences between the marketing/farmer support activities of the GCP and those of private agribusinesses are significant. To improve their marketing and farmer support program, which would then contribute to the stimulation of the oilseeds sector as a whole, the GCP could benefit by emulating several characteristics of the private sector. These improved practices would include:

(a) use of formal, written production contracts with growers;

(b) proper compliance with both the letter and spirit of production contracting;

(c) expansion of the extension cadre to service a production;

(d) pay farmers by bank draft within 10 days after lifting the crops;

(e) offer competitive prices and quantities to encourage farmers to adopt new oilseed varieties;

(f) reorganize the processing plant management to reflect the adoption of sound business management principles; and

(g) institute procurement policies that favor the use of solvent extraction over mechanical oil extraction.

4.5 The implementation of the suggestions listed above would amount to a radical reform of the GCP. The desirability of these initiatives depends primarily on the maturation of the institution. Private agribusinesses are driven primarily by the goal of profit maximization, while the GCP as a quasi-state organization must balance profit maximization with national interests to promote and protect the edible oils sector.

V. IMPLICATIONS FOR DONOR ASSISTANCE

5.1 There are several implications for donor assistance programs that stem from the ability of the agribusiness firms to act as a vehicle for rapid innovation, to improve the market security of the farmer and to expand the scope and improve the quality of marketing services. There are also implications for donor assistance, relative to rural equity, that stem from the bias of the agribusiness firms towards larger farmers.

5.2 Agribusiness firm in Pakistan have been shown to be a vehicle for rapid innovation in the case of maize and sugarcane. Through a combination of importing and efficiently managing new technologies with in-firm breeding and field testing, the companies are able to serve as a catalyst to agricultural innovation. It is important to note that the agribusiness firms maintain a high ratio of qualified agronomic staff to growers, that extension and outreach efforts are granted a high priority and that all the requisite facilities are provided to ensure close contact between the agribusiness extension corp and the farm community. For the donor community, programs to assist agribusiness firms to locate in areas where production campaigns need to be mounted would be a first step towards on-farm innovation. Programs to assist the private agribusiness sector in extension training is another area where the public sector spin-offs would be large. Third, programs taken to link infant agribusiness industries in Pakistan with overseas foreign firms is a means of supporting the local economy but, more importantly, effectively enlarges the range of new technologies that the agribusiness firm can transfer.

5.3 By providing a written contract to the growers, and by adhering to the word and spirit of the contract, the agribusiness firms have markedly improved the market security of the farm community. It is often the case in the developing world that insecure marketing arrangements, poor farm-to-market communication and coordination and a legacy of maltreatment in the marketplace can cause farmers to adopt a production position of extreme risk adversity. Often, agricultural pricing policies that are designed to stimulate production fail because difficulties in the marketing sector block the clear transmission of the pricing signal to the farmers. The tendency of the larger agribusiness firms to structure their source of supply through production and marketing contracts adds a legal framework for stability in the agricultural markets. When these contracts are properly adhered to, a behavioral model is established for both the firm and the surrounding marketing community. For the donor community, programs to encourage written firm-to-farmer and government-to-farmer production and marketing contracts is a means of stabilizing the agricultural markets. Of course, contract enforcement and adherence is far more important than the issuing of the contract. In the case of the State and parastatal

marketing concerns, it would be wise to promote the formation of an independent contract enforcement board that would oversee the proper execution of government-to-grower contracts.

5.4 Agribusiness firms can expand the market for agricultural produce and can improve the quality and caliber of marketing services provided to the farm community. The agribusiness firms serve as a link between the farm community and the larger consuming population. To meet the rising standards of the rapidly growing urban consuming population, the agribusiness firms must produce a product that is of a high enough quality level to satisfy a demanding population. This implies the introduction of grades and standards, modern packaging techniques, improved haulage, better storage and the other important components of a marketing system required to produce a high-quality agricultural product. For the agribusiness firms, market expansion through quality differentiation requires the development of a number of important improvements in marketing services. For the donor community, there are several implications of the tendency for agribusiness firms to prosper through product differentiation. In particular, projects which aim to establish product grades and standards, improve storage and expand the market for particular items would be well advised to work in conjunction with an agribusiness firm. The expertise of the agribusiness firms in creating linkages between various markets and in upgrading the caliber of marketing services to improve the quality of the processed product is a resource that should be drawn into assistance packages.

5.5 From an examination of four of Pakistan's leading agribusiness firms, it is apparent that the firms are biased in favor of larger or more progressive landholders. The agribusiness firms invoke economies of scale to ensure that they obtain the maximum return for their investment in production and marketing campaigns. For the donor community, it should be understood that programs to promote the introduction of agribusiness firms will be biased in favor of larger growers. However, the trade-off in question appears to be one of increasing the pace of innovation and improving the caliber of marketing services against the possible short-term aggravation of inequity in incomes. Where the linkages between the smaller farmers and the larger cultivators are good, the size-bias of the agribusiness firms can be eliminated in a short period of time. In other words, the donor community would best be advised to encourage agribusiness formation in areas where the linkages between larger and smaller farmers are well established as this would aid in spreading the beneficial effects of the agribusiness venture.

VI. CONCLUSIONS

6.1 The private agribusiness sector can serve to expand the market for agricultural produce, improve the quality and scope of marketing services, manage the introduction of new technologies and support those technologies once they are introduced. The evidence from Pakistan is that, given a good investment climate, the agribusiness firms are willing to invest in and support the introduction of new agricultural technologies. Often this is done in a fashion that is more rapid and more effective than parallel efforts by the government.

6.2 The evidence gathered from a survey of four leading agribusiness firms suggests that there is considerable scope for the private sector to augment the marketing and rural development services provided by the state sector. The notable difference between the performance of the government's agricultural firms and private agribusinesses is that the private firms use formal production contracts. These contracts add a measure of market security to both the processing factory and the grower which is the cornerstone of an economic atmosphere conducive to rapid agricultural development.

6.3 The farm community is benefited in several ways by contact with agribusiness firms. Farmers are more economically secure when they can depend on the agribusiness firm in addition to the private crop market. Farmers are able to adopt the new technologies introduced by the agribusiness firms and can effectively utilize the services provided by the firms. Except in the case of industries where smaller firms predominate, the agribusinesses tend to be biased more towards supporting the production efforts of the larger farmers.

6.4 Donor agencies should not consider support to the agribusiness sector as simply a subsidy or a transfer payment to private entrepreneurs. Instead, assistance to the private agribusiness sector should be viewed as a means for improving the caliber of marketing services, a vehicle for the rapid development and dissemination of new technology and, most importantly, as a means for promoting sustainable agricultural growth. Efforts to encourage the introduction of "model agro-industries" should be given a high priority in donor packages, especially in cases where partnerships or joint ventures between overseas firms and local operations can be established. There is evidence in Pakistan that these firms can prosper and that the fruits of their prosperity include the rapid dissemination of new agricultural technology and the improvement of a wide range of marketing and farmer support services.

A P P E N D I C E S

APPENDIX A.1

Processor Interview

Agro-Industrial Study of Production Contracting

Company: _____ Commodity Contracted: _____

Address: _____

Telephone: _____ Interview Date: _____

Company Representatives Interviewed:

Name	Title

I. HISTORY OF COMPANY'S CONTRACTING EXPERIENCE

1. Why did your company decide to use production contracts?

_____

_____

_____

2. What year did your company begin contracting with farmers?_____

3. How did you select or identify the first year's contract farmers?_____

_____

_____

Comments:

4. How did you select or identify contract farmers after the first year?_____

_____

_____

5. Could you summarize the scope of your contracting operations in the first year and up through the last 10 years?

YEAR	NUMBER OF CONTRACTS	TONS DELIVERED UNDER CONTRACT	TOTAL TONS PROCESSED	TOTAL FARMERS SELLING TO YOU
First ( )	_____	_____	_____	_____
1973/74	_____	_____	_____	_____
1974/75	_____	_____	_____	_____
1975/76	_____	_____	_____	_____
1976-77	_____	_____	_____	_____
1977-78	_____	_____	_____	_____
1978-79	_____	_____	_____	_____
1979-80	_____	_____	_____	_____
1980/81	_____	_____	_____	_____
1981/82	_____	_____	_____	_____
1982/83	_____	_____	_____	_____

II. CURRENT CONTRACTING PROCEDURES

1. During the last year/season, what price did your company pay for produce at the mill gate? Rs/_____?

   Contracted produce:_____
   Non-Contracted produce:_____

2. Does your company offer to pick up produce at the farm-gate? _____No [SKIP TO II.4]
   _____Yes

3. What do you charge for this marketing service?

   _____

   _____

Comments:

4. How do you determine the price that you guarantee contract farmers?_____

_____

_____

5. When do you pay farmers for their produce?_____

_____

6. What is the method of payment?_____

_____

7. What product quality standards do you require, and what penalties are enforced? (Quality factors include moisture content, spoilage, etc.)

QUALITY FACTOR	STANDARD	PENALTY

Comments:

B. How would you rate the quality of produce sold to you by contract farmers compared to all other produce?

_____ Much higher quality
_____ Slightly higher quality
_____ About the same quality
_____ Slightly lower quality
_____ Much lower quality

9. Do you provide technical assistance (advise, information, instruction) to contract farmers? ____ No [SKIP TO II.10]
____ Yes

a. How many technicians are available for assisting contract farmers? _____

b. What are the general qualifications/training of these technicians?_____
_____
_____

c. What technical assistance does your company provide farmers for the following production activities?

ACTIVITY	SCHEDULED FARM VISITS	FARM VISITS/ ADVISE ON REQUEST	GROUP INSTRUCTION	OTHER (DESCRIBE)
Land preparation				
Irrigation				
Planting				
Fertilization				
Weed Control				
Pest Control				
Harvesting				
Other (describe)				

Comments:

10. Does your company provide any production inputs (seed, fertilizer, etc.) to contract farmers?

_____ No [SKIP TO III].
_____ Yes

a. What inputs do you provide and how do farmers pay for them?

INPUT	PAYMENT METHOD: PROVIDED FREE BY COMPANY	CASH ON DELIVERY OF INPUT	COMPANY DEDUCTS COST FROM SALE PRICE	OTHER (DESCRIBE)
Seed				
Fertilizer				
Herbicides				
Insecticides				
Other (describe)				

b. How do the prices contract farmers are charged for company-supplied inputs differ from input prices paid by non-contract farmers?_____

_____

_____

_____

Comments:

11. Could you show a brief organizational diagram of your company's main operations?

    a. Where does the management of farmer contracts fit into the diagram?

    b. How are farmer contract operations coordinated with other company operations?_____

_____

_____

[DRAW DIAGRAM BELOW]

Comments:

III. CROP YIELDS

1. What is your estimate of the average yield of this crop among <u>local farmers who do not contract</u> with your company?

   _____ per _____
   (amount) (land unit)

2. What is your estimate of the average yield of this crop among <u>local farmers who contract</u> with your company?

   _____ per _____
   (amount) (land unit)

[INTERVIEWER: IF III.2 NOT GREATER THAN III.1 SKIP TO III.5]

3. Why do contract farmers have higher yields?_____

   _____

4. Once a farmer begins producing for your company under contract, how many crop seasons do you estimate are required before he reaches maximum yield with your technical assistance and price guarantees? _____

5. Do you have records on each contract farmer's production for each season? _____ No [SKIP TO IV]
   _____ Yes

6. Could we review these records to better understand the production performance of farmers who contract? _____

IV. CONTRACT LEGALITY

1. What actions does your company take if a farmer does not fulfill contract agreements?_____

   _____

2. How frequently do farmers fail to fulfill contract terms?_____

   _____

3. What are the most common contract terms that farmers fail?_____

   _____

Comments:

4. How frequently do farmers lodge complaints about your company's fulfillment of contracts?

_____ Frequently
_____ Occasionally
_____ Never [SKIP TO V]

5. What are the farmers' most frequent complaints?

_____

_____

6. How does your company usually resolve these complaints?

_____

_____

V. MILLING/PROCESSING OPERATIONS

1. What is your plant's processing capacity?

per day? _____ tons
per season? _____ tons
per year? _____ tons

2. How would your processing operations differ if you did not contract with farmers?_____

_____

3. What products are produced at your plant from farmers' contracted crops?_____

_____

4. What is the maximum economical distance that farmers' crops can be transported to your plant? _____ kilometers

VI. COMPANY EVALUATION OF FARMER CONTRACTING

1. Based on your company's experience, what are the major <u>advantages</u> of contracting:

a. For your company?_____

_____

Comments:

b. For farmers?_____

_____

2. What are the major disadvantages of contracting?

a. For your company?_____

_____

b. For farmers?_____

_____

3. What are the major features of your contract program that your would like to improve?_____

_____

_____

_____

Comments:

APPENDIX A.2

Farm Level Interview Agro-Industrial Survey

I. Date_____

Place: District_____ Tehsil_____
Village_____
Enumerator's Initials_____
Survey Number_____

II. Explain the following to each respondent:

We are conducting a survey of farmers to examine the effects of agro-industrial firms on crop adoption in the Punjab. We greatly appreciate your cooperation and all responses that you give will be kept strictly confidential.

III. Farm Category

1. How much land is owned _____ (acres)

   rented in _____, sharecropped in_____
   rented out_____, sharecropped out_____

2. How much area is irrigated _____
   unirrigated_____

   What is the source of irrigation (1-tubewell, 2-river 3-primary canal, 4-other canal, 5-other)_____

3. If you were to rent an acre of your land to another farmer for a year, what would you expect the rent to be_____

4. What crops did you produce last year; what was total production (fresh cut figures); and how much land did you allocate to each crop?

Crops	Production (kg or md)	Area (acres)
a.		
b.		
c.		
d.		
e.		
f.		
g.		
h.		

Comments:

IV. Farm Innovation: Questions are with regard to the specific crop in the agro-industrial area.

1. How many years has he been cultivating the crop?___

   When did he start to grow the crop under the company's contract?_____. What area did he sow to the crop in that year?_____. What was his production?_____.

2. Does he sell his produce to the company or elsewhere? (0-company, 1-elsewhere, 2-both)_____.

3. Why did you first decide to grow the crop under the contract? (1) good price; (2) secure market; (3) convinced by the company; (4) from neighbors' experience (5) other _____

4. What services does the company provide you?

   credit (y/n)_____ if so, how much/season_____
   seed (y/n)_____ if so, how much/season_____
   fertilizer (n/y)___ if so, how much/season_____

   Advice on how to grow the crops (y/n)____ if yes, how often per season is the farm visited_____

5. Does the company pick up the crops from the field? (y/n)_____

   Do they pick them up on time (y/n)_____

6. Who provided transport to the factory, you or the factory?_____. If the farmer provides transport, what is the cost of the transport?_____.

7. Has your produce ever been rejected by the company during any of the years you have sold to it? (y/n)_____. If yes, for what reasons?_____
   _____.

8. Is payment made on time by the company? (y/n)_____.

9. Have you had any difficulties with late-payment, underweighing or any additional deductions by the company? (y/n)____. If yes, explain_____.

10. If the crop doesn't grow well, due to weather, pests or other factors, does the company allow you to defer repayment of credit and have they ever written-off repayment of loans? (y/n/na)?_____.

Comments:

V. Farm Information: Questions about the particular crop.

1. Where does the farmer get information on crop prices? (a) market; (b) friends; (c) family; (d) radio/newspaper; (e) company; (f) other_____.

2. Where does the farmer get information on crop cultivation practices? (a) extension agents; (b) other farmers; (c) books/journals; (d) company representative; (e) other _____.

3. Does the farmer discuss cultivation practices with other farmers in the area? (y/n)_____.

4. Does the farmer have a contract with the company? (y/n)_____.

5. If yes, do you feel more secure having the contract? (y/n)_____. Please explain_____.

VI. Costs and Returns: For the particular crop.

Input Costs--per acre

Labor: number of persons/season_____
number of days/person_____
daily wage rate_____

Seed: number of kilos_____
cost per kilo_____

Fertilizer: quantity_____ cost_____
quantity_____ cost_____

Water Charges_____

Taxes, Other Charges_____

Returns

Quantity Produced_____

Percentage Marketed_____

Marketing Charges (transport, broker's fees)_____
_____

Sale Price_____

Comments:

VII. Retrospective Yield/Area Assessment:
for the particular crop

a. What was the projection and the area harvested over the past four years, starting with the most recent production. For any major production or area changes, ask the farmer why that occurred.

Crop_____

	Production	Area	Reason for Change
1982			
1981			
1980			
1979			

b. If he were not to grow this crop, what would he use the land for instead?_____.

What crop would he grow instead?_____.

c. (If he contracts) What are the major advantages of dealing with this particular firm?_____.

d. What are the major disadvantages of dealing with this particular firm?_____.

e. What would he like to improve most about his relationship with this firm?_____.

Comments:

APPENDIX B.1

AGREEMENT FOR MAIZE GROWING AND PROCUREMENT

This agreement entered into this _____ day of _____ 198_ at Faisalabad

between

Messrs. Rehfan Maize Products Company Ltd., Faisalabad, incorporated under Companies Act of 1913 which will hereinafter be referred to as "Company" in the above mentioned agreement as Party No. 1 AND

Mr._____S/O_____

Caste_____Village_____

Tehsil _____District_____

who will, in future, be referred to as owner/farmer in the above mentioned agreement as Party No. 2. Because "Company" requires maize for its mill at Faisalabad and the owner/farmer is willing to grow and deliver the maize to the Company, therefore both the parties have agreed to grow and procure maize on the following terms and conditions:

1. The owner/farmer on his land located at

   Village_____Tehsil _____

   District_____Area_____

   Will grow maize during the season _____ in accordance with the instructions of Company's agronomist.

2. The owner/farmer will act according to the instructions and satisfaction of the Company's agronomist regarding preparation of land, watering and sowing of maize.

3. The owner/farmer will use the seed provided by the Company whose price will be Rs._____ per maund/40 kgs. and will use the proposed doses of chemical fertilizer in accordance with the instructions of the Agronomist.

4. The owner/farmer will sow the maize according to the correct method and right time suggested by the Agronomist and will provide the manpower as needed.

5. Watering of crop will be the responsibility of the owner/farmer and this will be done in accordance with the instructions of the Company's Agronomist.

6. To fulfill the agreement, the price of seeds, pesticides, and Hysan cloth (jute bag) provided to the farmer by the Company will be considered as an advance for procurement of maize.

7. The above crop which will be produced through Company's seeds, pesticides and technical advice will be considered as Company's property and will remain with the owner/farmer as trust until such time it is handed over to the Company and the owner/farmer will have no right either to sell this crop to any other person or transfer it through other methods. Any violation in this regard will be considered as misappropriation. Moreover, the owner/farmer will use the seeds, pesticides and jute bags provided to him by the Company only for the crop for which this agreement has been set.

8. Protection of crop from insects will be made in accordance with the Agronomist's instructions, who will propose appropriate pesticides for this purpose. The Company will provide these pesticides, the price of which will be recoverable from the owner/farmer.

9. Hoeing of crop and removal of weeds from the crop will be the responsibility of the owner/farmer. The owner/farmer will have to do two hoeings and will have to remove weeds completely from the crop within six weeks. The farmer will also be responsible for putting soil on the crop roots if needed.

10. The crop will be accepted according to the Agronomist's instructions. The crop will not be accepted until and unless the humidity in the grain is less than 30%, the decision of which will be at the will of Agronomist.

11. The owner/farmer will protect the crop from wild animal and bird damage and from theft of any kind.

12. Company will procure from the owner/farmer all production of spring maize crop which has been grown under this agreement at the rate of Rs._____ per maund/40 kgs. dry grain having less than 15% humidity. This rate applies to dry grain. And if the owner/farmer will supply his produce to the Company in the shape of maize ears then in that case the Company will deduct a sum of Rs. 2 per maund/40 kgs., the cost of drying and threshing and other miscellaneous expenses from the value of the produce. For kharif crop (summer crop) the procurement rate will be that rate prevailing in the nearest local market at which the Company will be procuring maize for itself. Other terms and conditions for procurement will be the same as were for spring crop mentioned above.

13. If the owner/farmer will supply his produce to the company in the shape of maize ears then the owner/farmer will be required to meet the following conditions:

a) The grains of the ears will not have more than 25% humidity. Those ears having more than 25% humidity or having damaged grains will not be procured. The owner/farmer will be informed about this. If it is possible to separate these damaged ears then the cost of process will have to be borne by the owner/farmer.

b) In case of ears, the weight of dry grains will be estimated at the factory. The owner/farmer will accompany his produce or will nominate his representative to the factory, so that the weight of dry grains from ears could be estimated in his presence. In case the owner/farmer does not appear by himself or does not nominate his representative with his produce, then it will be deemed that factory's estimate is acceptable to the owner/farmer.

c) The produce will not be brought to the mill without the written permission of the Company's representative (which will be in the shape of procurement papers), otherwise the Company will not be responsible for payment.

14. When Company has borne the expenses on seeds and pesticides, and the owner/farmer has failed n some aspects of crop production which may affect the cro, production badly, then the Company will have the right to incur expenditure on activities leading to the success of crop production. All these expenses are recoverable from the owner/farmer, which the company will deduct from the value of the produce. If the crop is affected due to bad seeds or bad weather, then the Company will not be responsible for the damage.

15. In case the owner/farmer has more than 225 maunds/8399 kgs. of maize and if the produce is located at a mettled road or unmettled good track where a truck can move, then the Company will make, for the convenience of owner/farmer, arrangement to pick up the produce from the owner/farmer's house to the mill at Faisalabad. Otherwise owner/farmer will have to make arrangement for hauling of maize up to nearest mettled/unmettled good track. If the load in any truck is less than 225 maunds/8399 kgs., then the hauling charges for the deficient weight will be charged to owner/farmer's account.

16. Payment of maize grain will be made on the basis of weight done at the scale of the factory after it is received at the factory. The mode of payment will be through cheque or bank draft in accordance with the rules and regulations of the Company.

17. Since this agreement is set at Faisalabad, therefore in case of conflict, the parties can pursue their case through local courts of Faisalabad.

18. The heirs, dependents, and workers of the owners/farmers, Party No. 2 and anybody else directly or indirectly involved in this agreement will be bound to obey this agreement as the owner/farmer, the signatory of this agreement will be. If anyone of the dependents does not obey the agreement and does interfere in any respect, then in this case the owner/farmer will be responsible to pay for the damage done to the Company Party No. 1.

Signature: _____

Date: _____

Witness:

For Refhan Miaze Products Company Limited

Signature: _____

Name and Address: _____

_____

PARTY No. 1

Date: _____

Signature: _____

Date: _____

Witness:

PARTY No. 2

Signature: _____

Name and Address: _____

_____

Date: _____

GUARANTEE

I, _____ S/O _____

Caste _____ Tehsil _____

District _____

undertake that if owner/farmer fails in handing over maize crop or making payment of dues to the Company or becomes defaulter by violation of any of the terms and conditions of said agreement and thus causes damages to the Company then in this case I will be responsible as a guarantor for the payment of damage caused to the Company.

Signature of the Guarantor _____

Date: _____

Witness:

1. Name and address Signature: _____

2. Name and address Signature: _____

APPENDIX B.2

BABA FARID COMPANY CONTRACT

Pass Book No.: _____ Village: _____
Sector: _____ Source of Transportation: _____

Identity Card No. | | | | | | | | | | | | | |

Sugarcane Procurement Center: _____

Sr.	Sugarcane	....	....	Total	Est. Prod.*

Details of Credit	
Fertilizer	_____
	Rs. _____
Seed _____	Rs. _____
Others ____	Rs. _____
Previous Credit ___	Rs. _____
TOTAL:	_____

*Estimated Production

AGREEMENT

BETWEEN SUGARCANE GROWER AND
BABA FARID SUGAR MILLS LIMITED OKARA
UNDER
SCHEDULE NO. 4 OF WEST PAKISTAN
SUGAR FACTORIES CONTROL ACT 1950

Mr. _____ S/O _____ Cast _____
Village _____ Tehsil _____ District _____
Post Office _____

Who hereinafter will be referred to as Party No. 1 and General Manager who hereinafter will be referred to as Party No. 2 have agreed upon the following terms and conditions for sale and purchase of sugarcane:

1. Party No. 1 agrees that he will sell his sugarcane crop standing on _____ acres during the season _____, the particulars of which are given in the attached schedule and whose average yield will be _____maunds/acre and

estimated supply will be _____ to Party No. 2 at the minimum prices announced by the Government of Pakistan. The deduction from the crop will be made in accordance with the announcements made by the Government from time to time. Party No. 1 agrees that he will supply a good quality cane free from leaves, roots and tops to the factory gate or depot in quantity and on dates mentioned on the permit issued to him by the factory's authorities and which will be in accordance with the instructions of the Cane Commissioner.

2. Party No. 2 will accept the cane in such installments so as to finish farmer's crop before the end of the factory season.

3. If Party No. 1 resists to supply at least 80% of its sugar-cane crop which he should sell after deduction of seed requirements then Party No. 2 will fine for this short supply at such a rate that it will not be more than 1/16th of a Rupee per maund.

4. If Party No. 1 fails to supply cane to Party No. 2 for consecutive three permits issued to Party No. 1, then Party No. 1 will have no right to sell cane to Party No. 2 and this agreement will be treated as cancelled.

5. If Party No. 1 is ready to supply cane and Party No. 2 hesitates to accept the supply then Party No. 2 will be bound to pay the real price to Party No. 1 for cane which he failed to purchase. Besides this if Party No. 2 could not purchase this cane for some other reasons then it will pay to Party No. 1 for cane which it could not purchase at such a rate that it would not be more than 1/16th of a Rupee per maund. However, in case there is any shortfall in cane procurement after the 1st of April, then party No. 2 must compensate to Party No. 1 at such a rate that it would not exceed 1/8th of a Rupee per maund.

6. If Party No. 2 is not capable of purchasing cane under this agreement due to breakdown or failure of machinery or any other natural calamities or circumstances which were beyond the control of mill management then Party No. 1, after giving one week's notice to Party No. 2 and with the prior approval of the Cane Commissioner will be at liberty for disposal of its cane. In such a case no compensation will be paid to any party.

7. In case of violation of this agreement due to natural calamities or circumstances which were beyond the control of human beings, no compensation will be paid to any Party.

8. In case of any differences arising out of this agreement regarding quality of cane, delivery point or distribution of

permits or any other matter then these will be referred to an arbitrator for decision and no such case can be heard in any court of law.

Signature/Thumb Impression of Cane Grower

Representative of the Mill

Party No. 1

Party No. 2

Schedule
(Details of Cane Crop)

Date: _____

Variety of Cane	Square	No. of Kilos	Total	Estimated Production

APPENDIX 9.3

AGREEMENT FOR SUPPLY OF FRESH KAGHZI LIMES

An agreement made between _____ (hereinafter called the contractor) of the one part and M/s Mitchell's Fruit Farms Ltd., Renala Khurd (hereinafter called the Company) of the other part for supply of fresh Kaghzi Limes by the contractor on the following terms and conditions:

Quantity: 250 (Two Hundred and Fifty Mds. only) of fresh Kaghzi Limes of yellow colour, fully ripe and free from disease, suitable for shred, pickles and juice extraction. The fruit shall not be dry and cull. The fruit having "Chitri" will not be accepted.

Price: Rs. 180.00 (Rupees One Hundred and Eighty only) per 40 kg.

Deliveries: Deliveries will be made @100 to 150 mds. of Limes starting from August 3, 1983 except Fridays and Holidays.

Security: A sum of Rs. 2250/= (Rupees Two Thousand Two Hundred and Fifty only) will be retained by the Company as security for the proper discharge of the contract from the first payment due to you. This amount will be reimbursed to you in full upon successful completion of the contract. In case of any default to carry out the contract as agreed to herein, this security will be forfeited to the Company and you will have no right for its refund to you. In addition the Company will hold you responsible for the amount involved in re-purchase of the limes at your risk and expense. The amount so involved will be recovered from your other credits or personal assets.

Payment: Payment shall be made daily against actual supply of the fruit per day.

Please sign on the original copy of this Agreement in token of your acceptance of the above terms and conditions for supply of Kaghzi Limes.

for MITCHELL'S FRUIT FARMS LTD.,

_____ SUPPLY MANAGER

(Contractor)

AM:RA:

Copies to: (1) Contract File
(2) Production Manager (F/P)
(3) Accounts
(4) Office Copy

APPENDIX D.4

AGREEMENT FOR SUPPLY OF FRESH TOMATOES

AN AGREEMENT made between _____ (hereinafter called the Contractor) of the one part and Mitchell's Fruit Farms Ltd., Renala Khurd (hereinafter called the Company) of the other part for supply by the Contractor of fresh tomatoes on the following terms and conditions:

Quantity: ____maunds of tomatoes fresh, fully ripe, free from disease and suitable for extraction. Tomatoes found unfit for extraction shall be rejected on the contractor's account.

Price: As mutually agreed price for first half of the total contracted quantity shall be Rs. 40/- (Rupees forty only) per 40 kg tomatoes delivered by the contractor and accepted by the Company. This price is inclusive of freight, loading/unloading and Octroi charges which will be borne by the contractor. Market fee will be paid by the Company.

Price for the remaining quantity of tomatoes shall be settled mutually as per prevailing prices in the market at that time.

Deliveries: Deliveries shall be made daily as per Company's requirements except on Fridays and other holidays.

Security: A sum of Rs._____ (Rupees_____ only) shall be retained by the Company from the first payment due to the contractor, as security for the proper discharge of the contract. This amount will be refunded to the Contractor in full on successful completion of the contract. In case of any default to carry out the contract as agreed to herein this security will be forfeited to the Company and the contractor shall have no right for its refund to him. In addition the company will hold the contractor responsible for the amount involved in the re-purchase of the tomatoes at his risk and expense. The amount so involved will be recovered from his credit or other assets.

Payment: Payment shall be made against actual quantity of tomatoes accepted by the Company.

Given under our hands this 1st day of June 1983.

for MITCHELL'S FRUIT FARMS LTD.,

_____ (Contractor)

SUPPLY MANAGER

APPENDIX B.5

PAKISTAN TOBACCO COMPANY LIMITED

FCV, DV, BURLEY. *	
AGREEMENT NUMBER	

TOBACCO - CROP 19

DEPOT / SUB-DEPOT

No. OF BARNS	QUANTITY CONTRACTED (kgs)	BUYING PERIOD	
		FROM	TO

PARTICULARS OF TOBACCO GROWER	
NAME	
FATHER'S NAME	
VILLAGE	
TEHSIL	
DISTRICT	

* STRIKE OUT WHICH IS NOT APPLICABLE.

AGREEMENT FORM

This AGREEMENT is made on the _____

day of _____, BETWEEN Mr./M/S _____

_____, Tobacco Grower (hereinafter called Grower)

of Village _____ Tehsil _____ District _____,
of the one part, *and* the PAKISTAN TOBACCO COMPANY LIMITED (hereinafter called Company) of the other part.

And whereas in pursuance of the said Agreement, the Grower is desirous of supplying tobacco of the type required by the Company on the stipulated terms and conditions and the Company is prepared to accept tobacco from the Grower on the mutually agreed terms and conditions.

Now These Presents Witness and the parties hereby agree mutually as follows :—

I. OBLIGATIONS DISCHARGEABLE BY THE GROWER.

1. That the Grower will plant only those Flue-Cured Virginia, Air-Cured Virginia, White Patta and Burley varieties which have been approved by the Pakistan Tobacco Board.

2. That the Grower shall not apply pesticides of chlorinated hydrocarbon group and will only use phosphatic pesticides recommended by the Pakistan Tobacco Board. Any deviation from this obligation will render such tobacco unacceptable to the Company.

3. That the tobacco offered by the Grower will be grown either on his own/leased land and cured in his own/leased barn

4. That tobacco will be properly cured, graded and offered for sale to the Company at the premises specified by the Company according to the plant position viz: bottom leaf, middle leaf and top leaf.

5. That the Grower shall offer tobacco of the specified description and will not mix leaves of one grade with another grade or indulge in advertent or in-advertent admixture of water or other substance for the purpose of gaining any undue advantage in weight.

6. That tobacco offered by the Grower will be correctly graded by him on the basis of specification laid down by the Pakistan Tobacco Board and moisture content of tobacco shall not be less than 11% or more than 13%.

7. That the Grower shall sell contracted quantity of flue-cured virginia, air-cured virginia and burley tobacco to the concerned Company only and will not enter into agreement for the sale of same quantity of tobacco with more than one Company

8. That the tobacco offered by the Grower for sale will be inspected by the Company's buyer and the Company will purchase only such tobacco which in its opinion is suitable for purchases and at the price determined by the Company's buyer, which shall not be less or more than the prices notified by the Federal Government from time to time for various types and grades of tobacco. The Company will have the right to reject any tobacco which it considers unsuitable for its purpose.

9. That the price of tobacco purchased by the Company will be paid to the Grower through a branch of the scheduled Bank designated by the Company.

10. That the Company shall not be responsible for any loss, damage or deterioration which may occur or result to any part of the tobacco brought by the Grower for sale to the Company whilst it is lying at the Company's premises prior to its actual acceptance or after rejection.

11. That all rejected tobacco shall be removed by the Grower from the Company's premises at his own cost on the very day of its rejection.

12. That the Company shall not be held responsible for any failure to purchase or for any interruption or delay in purchasing part of tobacco offered by the Grower on account of causes beyond its control, such as civil commotion, war, riots, strikes, lockouts, earthquakes, lightning, tempest, flood, cyclone or by other force accident or cause.

13. That the Agreement shall automatically stand terminated if the Grower fails to fulfill any of the requirements/conditions stipulated above.

II. OBLIGATIONS DISCHARGEABLE BY THE COMPANY.

1. That the scales and weights used by the Company shall be those as have been certified by the Weights and Measures Department.

2. That the Company shall buy tobacco of flue-cured virginia, air-cured virginia and Burley from the agreement-holder only and not from 'Azad' Grower or Tobacco Agent.

3. That the Leaf Purchase Voucher issued by the Company shall indicate the gross weight of each bale, the deduction on account of tare-weight which shall not be more than what has been specified by the Pakistan Tobacco Board for different types of baling material and Leaf Purchase Voucher shall also indicate the net weight for which the Grower is entitled to receive payment.

4. That the Company shall provide all necessary facilities to the Grower in offering his tobacco at specified purchase Depot/Sub-Depot in accordance with the delivery schedule.

5. That the Company shall provide all necessary facilities to the Grower during his visit at the Purchase Depot/Sub-Depot in the form of shelter and drinking water.

6. That the grade and price as determined by the Company's buyer shall be clearly communicated to the Grower.

7. That the Company will exhibit/display tobacco leaves of various types and grades in suitable frame at the Purchase Depot/Sub-Depot with the Federal Government Notified price written in bold figures below each type/grade for the facility of Grower.

8. That the Company will not reject any tobacco which meets its requirements unless it suffers from such defacts as renders it unfit for purchase.

9. That the Company will not object to withdrawal of any bale from the buying court at the time of purchase if he is dissatisfied with the assigned price.

10. That the Company will arrange to make payment of Grower's dues through the branch of its designated Bank within a period of 30 days in the manner specified here-under :—

(i) Payment in respect of tobacco purchased during the first fortnight ... ... Within seven days.

(ii) Payment in respect of tobacco purchased during the second fortnight ... ... Within fifteen days.

(iii) Payment in respect of tobacco purchased during the third fortnight ... ... Within twenty one days.

(iv) Payment in respect of tobacco purchased after the third fortnight ... ... Within thirty days.

11. That the Tobacco Companies shall not, without ostensible strong reasons, cause any suspension of purchases or reduction in volum· of intake during marketing season to the inconvenience of the growers.

12. That the Company will carry out a survey of tobacco after execution of this Agreement and that it will stand cancelled where the Grower has not planted the tobacco and in lieu thereof fresh Agreement shall be executed with the Grower who had planted tobacco but has not been able to secure an agreement.

PAKISTAN TOBACCO COMPANY LTD.

Signature etc of Grower or his authorised repre:entative

_____

Leaf Buying Manager / Buyer

_____

Witness

Name_____

Date_____

Witness

Name_____

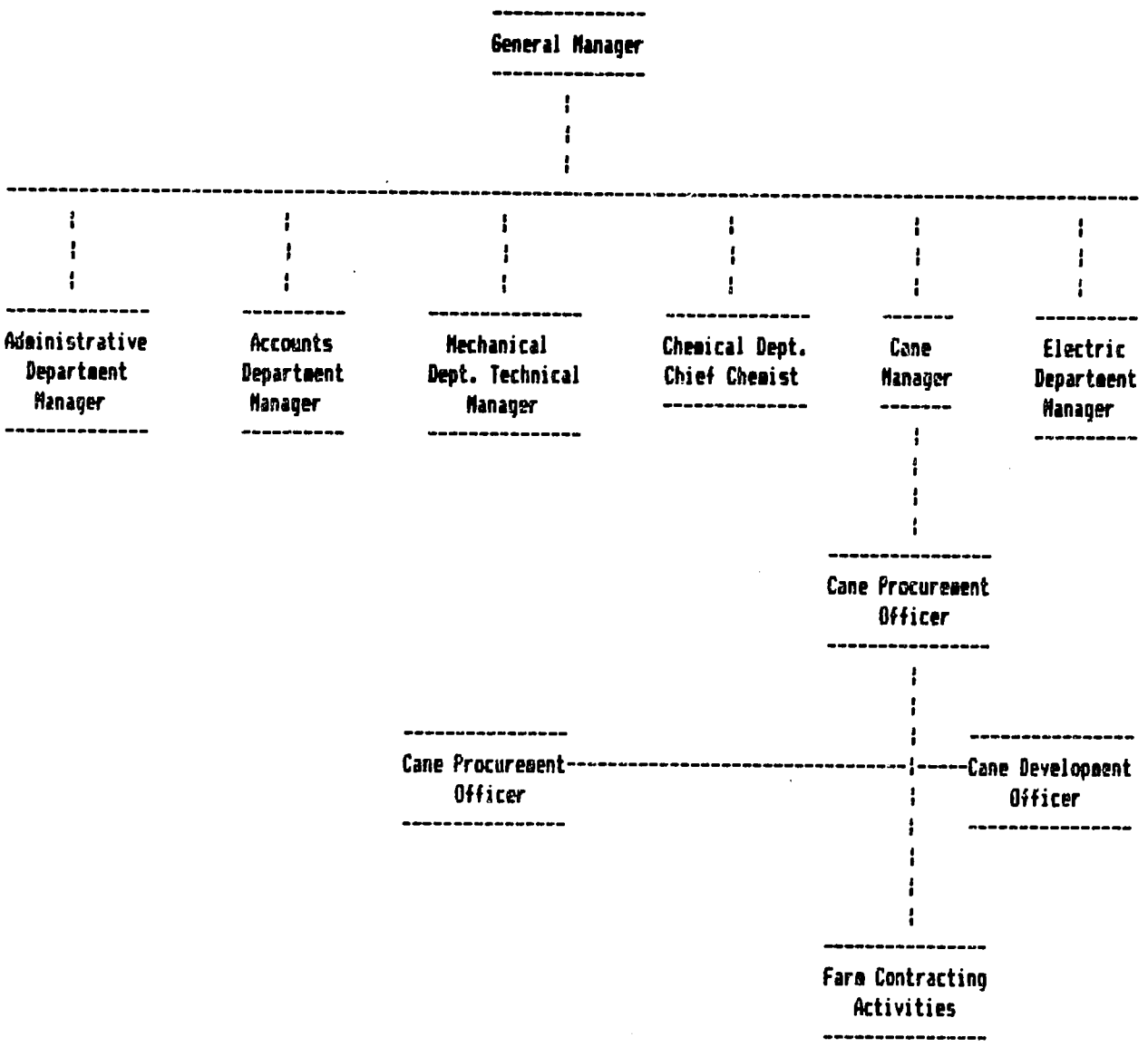
Date_____

LEAF OFFERING

Date	Lot No.	No. of Bales	Buying Days Allocated	Initials

APPENDIX C.1

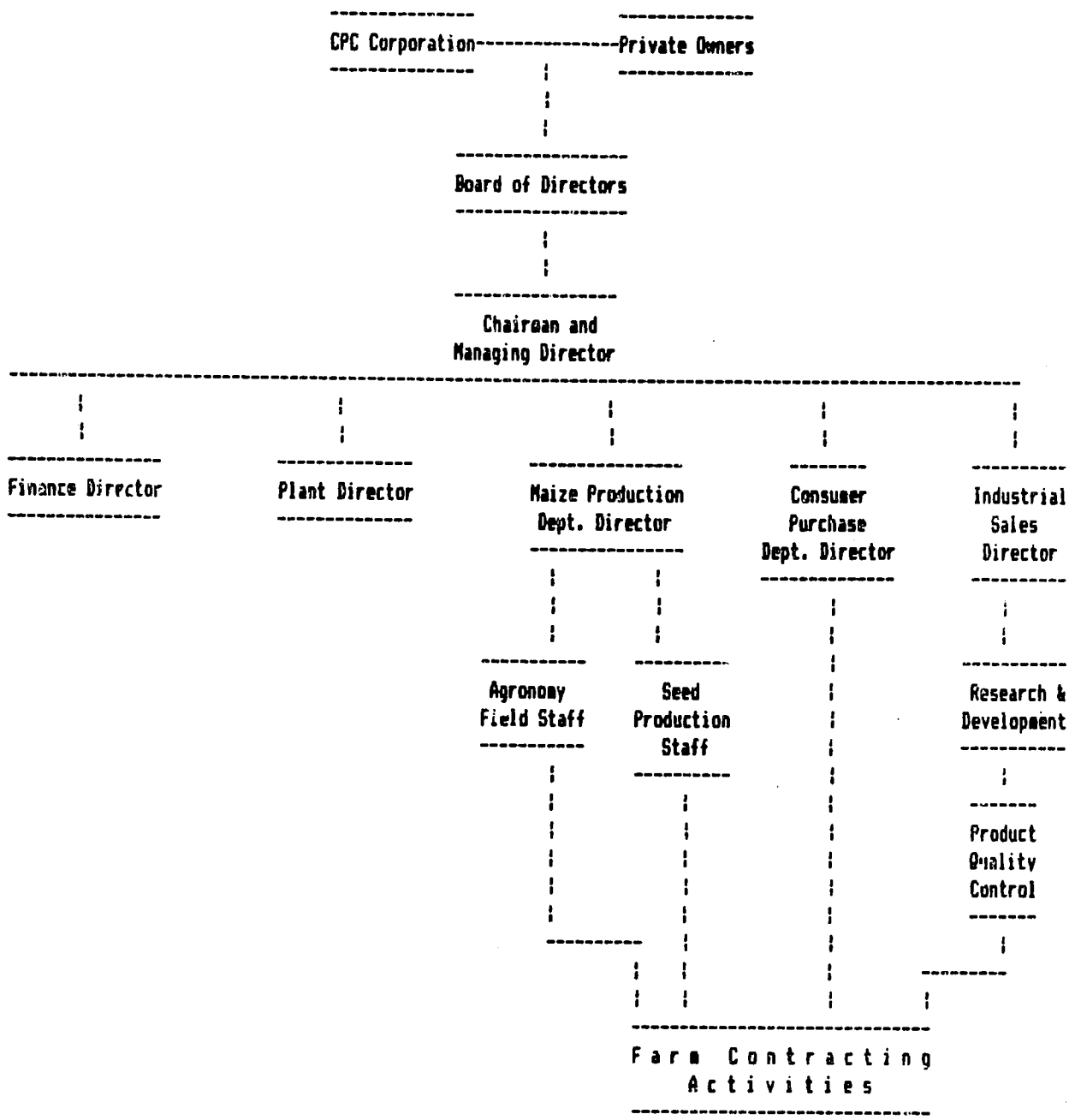
ORGANIZATIONAL CHART OF BABA FARID SUGAR MILLS LTD.,
OKARA, PUNJAB



Source: Baba Farid Sugar Mills, Ltd., Okara, 1983.

APPENDIX C.2

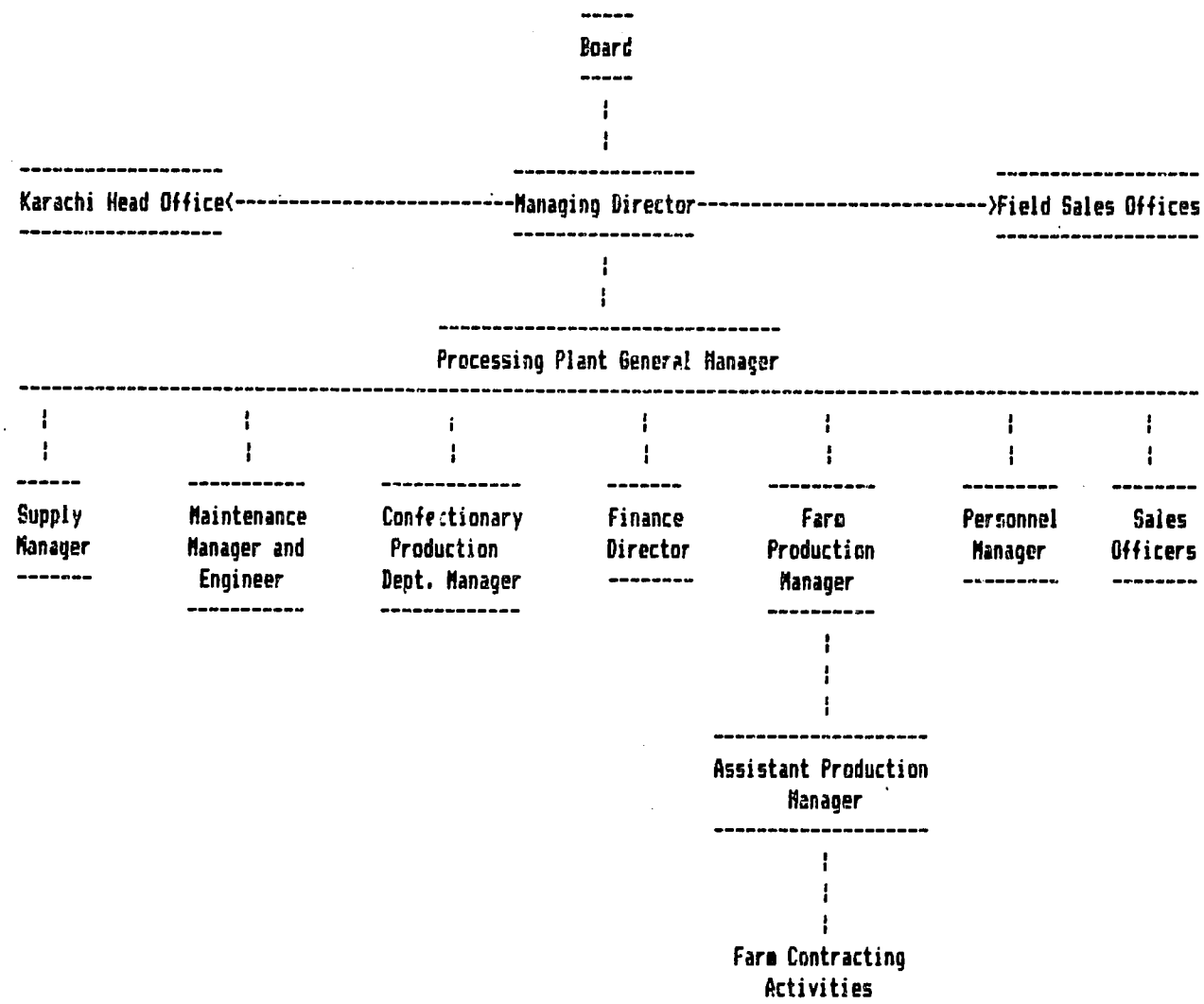
AN ORGANIZATIONAL DIAGRAM
OF RAFHAN MAIZE PRODUCTS CO., LTD.



Source: Rafhan Maize Products Co., Ltd., August 1983.

APPENDIX C.3

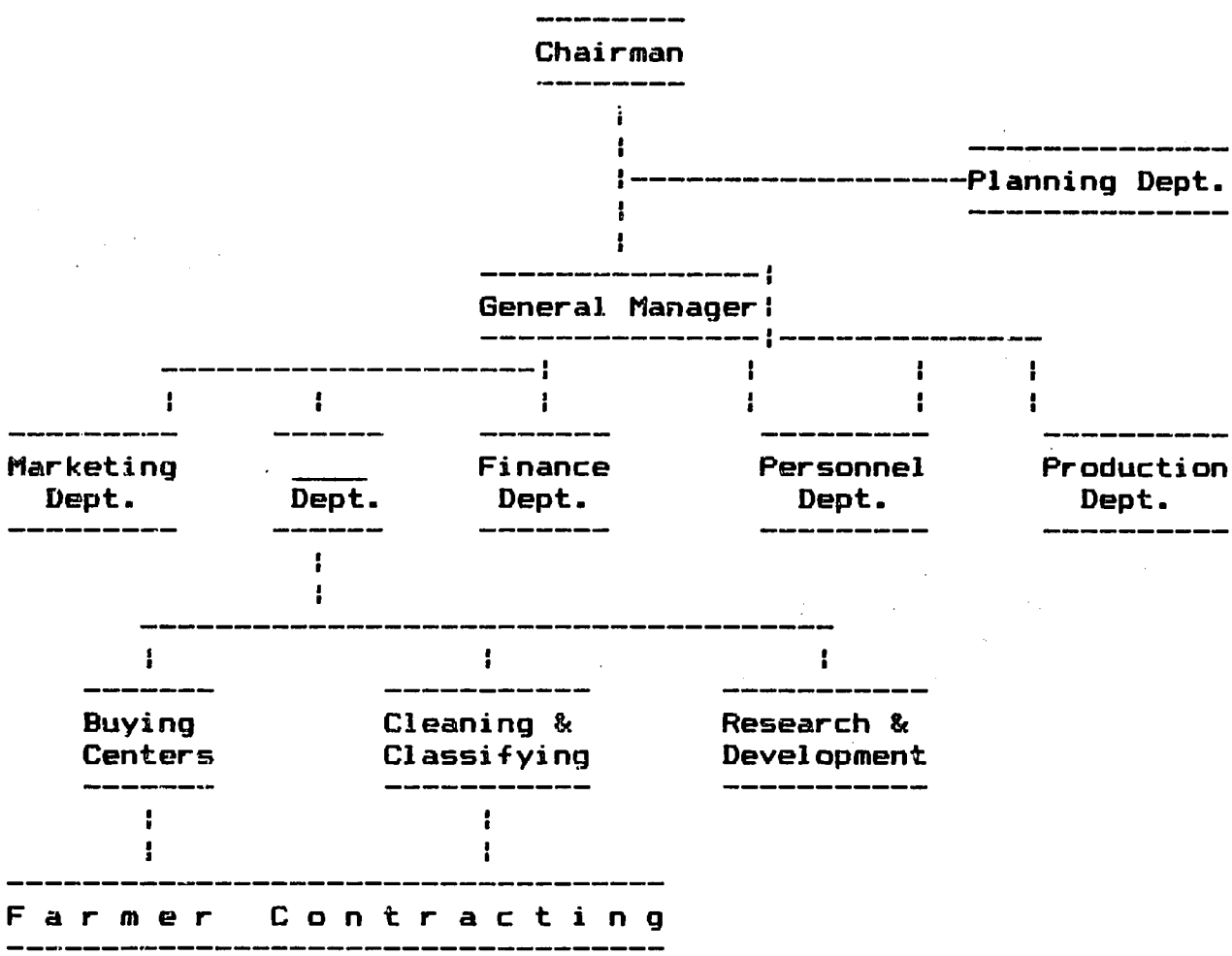
AN ORGANIZATIONAL DIAGRAM OF THE MITCHELLS FRUIT FARM LTD.



Source: Mitchells Fruit Farm Representatives, September 1983.

APPENDIX C.4

ORGANIZATIONAL CHART OF THE PAKISTAN TOBACCO COMPANY, NOWSHERA



Source: Pakistan Tobacco Company, Ltd., Nowshera, 1983.

APPENDIX D.1

TONNAGE PROCESSED BY MITCHELL FARMS INC., 1982/1983*

Commodity	Tons Per Year
Oranges	515
Grapefruit	80
Lemons	40
Apples	106
Plums	14
Mangoes	320
Guavas	45
Apricots	25
Tomatoes	850
Peas	50
Onions	26
Green Chillies	3
Sweet Corn	62

*Note: Roughly half of Mitchell Farms net returns are accounted for by confectionary items (sweets); fruit fillings are used in many of the sugar-based items.

Source: Mitchell Farms representatives, September 1983.

APPENDIX D.2

CONTRACT MAIZE PRODUCTION BY RAFHAN: 1973-80

Year	No. of Farmers	Area (Acres)			Production (Tons)			Yield (Kgs/Acre)		
		Summer	Spring	TOTAL	Summer	Spring	TOTAL	Summer	Spring	Average
1973	238	3,000	1,900	4,900	3,124	1,929	5,053	1,041	1,015	1,031
1974	180	2,000	1,600	3,600	1,925	1,653	3,578	963	1,053	994
1975	371	3,500	6,720	10,220	3,306	6,429	9,735	945	957	953
1976	526	9,738	8,000	17,738	9,920	7,991	17,911	1,019	1,000	1,010
1977	486	4,908	11,578	16,481	3,490	12,847	16,337	712	1,110	991
1978	768	7,745	16,000	23,745	4,500	13,134	17,634	581	821	743
1979	675	4,000	14,205	18,205	2,388	13,644	16,032	597	960	880
1980	822	7,135	21,821	28,956	4,350	17,218	21,568	610	789	745

Note: Area means area harvested.

Data supplied by Rafhan Company officials, August 1983.

APPENDIX D.3

FLUE CURED VIRGINIA TOBACCO GROWERS OF THE PAKISTAN TOBACCO COMPANY

Barns Held	1978 No. of Growers	1978 No. of Barns	1983 No. of Growers	1983 No. of Barns
1	4,498	4,498	3,759	3,759
2	725	1,450	352	704
3	134	402	81	243
4	39	156	19	76
5	16	80	14	70
6	6	36	1	6
7	6	42	1	7
8	-	-	-	-
9	-	-	-	-
10	1	10	-	-
11	1	11	-	-
TOTAL:	5,426	6,685	4,227	4,865

Source: Pakistan Tobacco Co., 1983.

APPENDIX E

A Statistical Analysis of Sugarcane and Maize Production

E.1. Multiple linear regression models were constructed to assess the impact of production contracts on surveyed sugarcane and maize farmers. Thirty of the 40 maize farmers interviewed held formal production contracts with Rafhan during the last crop season and were designated as "contract farmers" for this analysis. Although practically all farmers selling sugarcane to the Baba Farid Mill have production contracts, the mill provides intensive technical assistance and supervision to about one-third of the growers. Twenty of the 41 sugarcane farmers interviewed were closely supervised during the last season and were designated as "contract farmers" for this analysis.

E.2. Yield functions were estimated to assess the differential impacts of time and contracting on yield after accounting for variation in other farm characteristics. A general regression model was specified where yield per acre (100 kg) is a linear function of:

(1) size of farm (acres);

(2) percentage of the farm owned by the operator;

(3) percentage of the farm planted in the crop in question;

(4) T, a time index denoting the tth year that the farmer grew the crop; and

(5) a contract dummy variable ("1" = "contract or supervised;" "0" = "non-contract or unsupervised").

The time index, T, was incorporated to estimate the impact of experience or "learning by doing" on yields. The time index also serves as a proxy for measuring the degree of innovation and diffusion. The 40 maize farmers and 41 sugarcane farmers were asked to estimate the acreages and yields for the first year the crop was grown, and for the last four seasons. These responses produced 154 maize observations and 113 sugarcane observations for pooled cross section-time series models. The estimated regression equation results are shown in Appendix Table E.1. Supervised ("contract") sugarcane growers produced about 5,400 kg per acre more than unsupervised growers, and the regression coefficient is highly significant. The time index, T, indicates that sugarcane yield increases slightly, althoughly insignificantly, with experience.

Appendix Table E.1

Estimated Yield Functions

Variable	Sugarcane Equation	Maize Equation
Constant	278.83	9.74
Farm Size	.27 (.11)[a]	.002 (.003)
% of Farm Owned	-.98 (.36)[1]	.028 (.018)
% of Farm in Crop	.84 (.40)[a]	.042 (.02)[a]
T (year)	1.22 (1.10)	-.054 (.073)
Contract Dummy	54.98 (20.03)[1]	1.72 (.96)
N	113	154
R Sq.	.2	.11

Regression standard errors are in parentheses.

[1]"t" test is significant at the 1 percent level.

[a]"t" test is significant at the 5 percent level.

Sugarcane yield increases as both farm size and specialization in the crop increase. Farmers who rent most of their land appear to have higher sugarcane yields than farmers who own most of their land. Contract maize farmers have higher yields, although the difference is insignificant. Maize yields also increase as farm size and crop specialization (percentage of the farm planted in the crop) increase. Maize farm owners appear to have slightly higher yields than renters, but the difference is insignificant. Maize yields decline slightly with experience, but the coefficient is insignificant.

E.3. Crop acreage was regressed on the independent variables specified in E.2 as another estimate of innovation and diffusion. The results of the acreage model are shown in Appendix Table E.2.

Appendix Table E.2

Estimated Acreage Functions

Variable	Sugarcane Equation	Maize Equation
Constant	-15.43	-34.75
Farm Size	.12 (.02)[1]	.197 (.02)[1]
% of Farm Owned	.017 (.058)	.096 (.13)
% of Farm in Crop	.4 (.064)[1]	1.057 (.14)[1]
T (year)	.33 (.18)[2]	2.3 (.51)[1]
Contract Dummy	9.66 (3.22)[1]	-2.6 (6.6)
N	113	154
R Sq.	.47	.65

Regression standard errors are in parentheses.

[1]"t" test is significant at the 1 percent level.

[2]"t" test is significant at the 10 percent level.

Both sugarcane and maize farmers have expanded their respective acreages over time, and the estimated coefficients are significant. Supervised sugarcane farmers plant about 9.7 more acres than unsupervised growers, and the difference is significant. In contrast, contract maize farmers tend to grow slightly smaller acreages of maize than non-contract farmers, but the difference is insignificant. Both sugarcane and maize farmers' respective crop acreages increase with farm size (significant), percent of farm owned (insignificant), and degree of crop specialization (significant). The crop specialization variable would be expected to have a positive, significant association with crop acreage because of their specification.

E.4. A Cobb-Douglas type production function was estimated to evaluate the impacts of contracting, net of input variation on yields. Appendix Table E.3 shows the results of regressing the natural logarithm of the 1982 yield per acre on the natural logarithm of five different production costs and the linear, additive contract dummy variable. All of the regression coefficients are not significantly different from zero at the 10 percent level and two input coefficients in each equation have negative signs. Although the contract coefficients are insignificant, they estimate that supervised growers' yields exceeded non-supervised growers by almost 17 percent last year, while contract maize yields exceeded non-contract yields by about 9 percent.

Appendix Table E.3

Estimated Production Functions

Variable	Sugarcane Equation	Maize Equation
Constant	3.959	2.828
Labor Cost	.189 (.185)	.134 (.195)
Fertilizer Cost	.221 (.148)	-.062 (.068)
Water Cost	-.063 (.094)	.038 (.115)
Seed Cost	.249 (.654)	.25 (.4)
Other Costs	-.064 (.129)	-.105 (.157)
Contract Dummy	.169 (.104)	.091 (.371)
N	41	40
R Sq.	.19	.13

Regression standard errors are in parentheses.

No regression coefficient is significant at the 10 percent level.

E.5. Net returns per acre were regressed on all independent variables specified in E.2, except time. The results of the model are shown in Appendix Table E.4. Net returns were specified as rupees per acre during 1982. Most studies find great variability in profits between firms and this study was no exception.

Appendix Table E.4

Estimated Net Returns Equations

Variable	Sugarcane Equation	Maize Equation
Constant	1899.3	382
Farm Size	2.93 (4.4)	-.32 (1.25)
% of Farm Owned	-1.63 (13.2)	13.56 (8.43)
% of Farm in Crop	31.07 (15.3)[1]	3.74 (9.57)
Contract Dummy	848.31 (737.6)	17.73 (427.8)
N	41	40
R Sq.	.14	.09

Regression standard errors are in parentheses.

[1]"t" test is significant at the 5 percent level.

E.6. Although the regression models generally explain less than one-half of the variation in the dependent variables, they consistently indicate that farmers receiving intensive technical assistance and supervision under the provisions of a formal production contract have higher yields than other farmers. Over time, surveyed sugarcane and maize farmers have increased their acreages of the respective crops. Interviews suggest that increased market stability and technical assistance provided by Rafhan and Baba Farid have allowed farmers to take greater production risks and expand their acreages. A farm-level

assessment of yields over time is much more difficult than the acreage question because it represents a culmination of each farmer's unique resource combination.

Although Baba Farid has operated only three years, its technical assistance program has made great progress. In contrast, Rafhan has been involved in maize contracting for more than a decade. The major effects of Rafhan's introduction of hybrids and other technical assistance into a farm community probably has its most dramatic impact during the first five years. In the Okara area, non-contract maize farmers' yields are not significantly different from contract growers because they have received external benefits from the contract program: a new market for hybrid seed; increased competition and security in local maize markets; and new sources of production technology passed on by contract farmers to their less innovative, more cautious neighbors.

OILSEED PRICE POLICY

AND

IMPLICATIONS FOR THE EDIBLE OILSEED PROJECT

Steven R. Tabor

Agricultural Economist/Consultant

Baltimore, Maryland

February 16, 1983

OILSEED PRICE POLICY

Recommendations

1. That a positive pricing regime be instituted for vegetable ghee and the edible oils. This would involve a gradual, real increase of procurement and retail prices of edible oils and ghee on the order of five percent per year. A four to five year period of corrective pricing should enable market prices to reflect domestic scarcities.

2. That a crop and livestock management unit be established. Its mandate would include the collection and analysis of information for formulating price policy. This would include information on costs and returns collected from farm household studies and market flow and financial analysis for essential food commodities.

Background

In this report, the nature of oilseed pricing policy on the production, distribution, consumption and trade of edible oils will be discussed. There is a growing recognition that GOP pricing policies have discouraged growth in edible oilseed production, given rise to an inefficient processing system, encouraged the rapid rise in ghee consumption and most pressing of late, led to a sharp rise in the import of edible oils. The adoption of a positive pricing regime would demonstrate the GOP's commitment to the development of the edible oilseed sector and promote the sector's rapid, rational development.

PRICE POLICY AND CONSUMPTION OF EDIBLE OILS

1. The average Pakistani consumes about 42 grams of fat per day, with a relatively low proportion derived from vegetable sources. Only 60 percent of the total fat consumption in Pakistan is from vegetable sources, while in Sri Lanka, a nation with a similar per capita income level, vegetable sources account for over 90 percent of the total fat supply. This reflects, in part, the inability of the oilseeds sector to provide the population with an adequate supply of low-cost vegetable fat.

2. As incomes rise, there is room for significant expansion in the consumption of edible oils. Pakistan's fat consumption is less than a third of that in Sweden and under half the level of that in Argentina. Edible oil is an important complement to a diet based largely on grains, as is the case in Pakistan today.

3. Ghee is widely consumed by all segments of the Pakistani population. In 1971/1972, average per capita consumption of milk-based desi ghee was .46 lb per month, and the consumption of vegetable oil was .43 lb per month. Consumption of both vegetable ghee and desi ghee were more equally distributed across income groups than was that of various luxury foods such as chicken and eggs. The consumption of edible oils in 1971/72 was less equitably distributed across income classes than was that of wheat or rice.

4. Vegetable ghee consumption has increased at a rate of nine percent per year over the past three years. It is estimated that in 1982/83 the average Pakistani consumer will obtain close to seven kgs of ghee for household purposes. Per capita consumption of vegetable ghee has increased by approximately six percent per year during the past three years.

5. The factors responsible for the increase in consumption of vegetable ghee are population growth, rising income, decreasing real prices of ghee and deterioration in the price of ghee relative to other foodstuffs. Population growth is rising at a rate of three percent per year and gross national income has been rising at a rate of five to seven percent during the past three years. Consequently, per capita income during this period has increased at an average rate of nearly three percent. During the past six years, the real price of vegetable ghee has dropped relative to a market basket of consumer prices. The price of ghee relative to the administered price of wheat has also declined.

6. Vegetable ghee prices in real terms have declined at an average rate of seven percent per year over the past six years. Retail ghee prices are administered by the federal government. Starting in 1976/77, retail ghee prices, relative to the consumer price index, have been declining at an uneven rate. Relative to the other items in the Pakistani consumer's market basket, ghee has become 43 percent less expensive in 1981/82 than in 1976/77. In 1970 Rupees, the price of vegetable ghee in 1975/76 was 4.32 Rs/kg. In 1981/82, the real 1970 price was 2.76 Rs/kg. The decline in ghee prices accounts for nearly half the growth in ghee consumption in Pakistan.

7. During the 1970's, the price of wheat increased by fifty percent more than the price of vegetable ghee. In the early 1970's, a kilogram of wheat was selling at the retail level for approximately ten percent of the price of ghee. By the late 1970's and early 1980's, the cost of a kilogram of wheat was 15 percent of the cost of a kilogram of vegetable ghee. Wheat consumption has also increased rapidly during the 1970's which, because of the complementarity between wheat and ghee consumption, has also added upward pressure on ghee consumption.

8. During the past ten years there has been a significant shift in ghee consumption from a milk to a vegetable base, as is reflected in retail product prices. Desi ghee, a milk-based product, has lost a significant share of the ghee market to vegetable ghee and vegetable oils. In the early 1970's, desi ghee was, by weight, twice as expensive as vegetable ghee. By 1980, desi ghee was nearly three times as expensive as vegetable ghee. In many rural areas, desi ghee is still the preferred cooking medium, although vegetable ghee is now widely marketed thoughout the countryside. The higher price of desi ghee is a reflection of both the product quality preference and the thinner market for this product.

9. Even if the GOP were to enforce a five percent increase in ghee prices each year for the next ten years, ghee consumption would still be 30 percent higher in 1990/91 than in 1980/81. Based on various econometric studies, the income elasticity (percentage change in consumption for a percent change in income) is on the order of .9, and the own-price elasticity is on the order of -.6. If incomes were to rise in per capita terms by three percent, and ghee prices were, in real terms, increased by five percent per year, the consumption of ghee would rise from nearly 700,000 metric tons in 1981/82 to 900,000 metric tons in 1991/92. If prices were to remain constant at 1981/82 levels, a doubling of ghee consumption in slightly over eleven years could be expected. If prices were allowed to continue declining, then ghee consumption would rise at an even faster rate.

OILSEED POLICY AND THE PRODUCTION OF EDIBLE OILS

1. Aggregate production of edible oils has grown at a rate of 1.2 percent per annum since 1973/74. Production has declined from peak levels of 251,000 MT in 1978/79. The production of nontraditional oilseeds has doubled between 1973/74 and 1981/82, although it accounts for only eight percent of total edible oil production. Throughout this period the acreage planted to cotton, rapeseed and mustard has increased marginally, while yields have stagnated.

2. The real wholesale price of cottonseed oil dropped 43 percent between 1971/72 and 1980/81. The wholesale price of cottonseed oil also declined relative to the wholesale price of wheat--a major competing crop. The declining real price contributes to an atmosphere in which few economic incentives exist to encourage the adoption of improved production techniques.

3. Several studies of farm level costs and returns show that returns from the traditional oilseed crops barely cover

production costs. For all the oilseed crops fertilizer application is sharply below recommended levels, broadcasting is the common planting method and there is little chemical pest control. Sub-optimal input application is a reflection of the low profitability of edible oil production.

4. An econometric assessment by the Punjab Economics Research Institute concludes that, "relative to other crops, the area's response to price changes is slight for the traditional oilseeds."[1] The estimated short-run, price-area elasticity was .25, implying that a ten percent farmgate price increase would lead to a 2.5 percent increase in cropped area. Output response, however, if viewed in a quantity of adjustment framework, would be significantly greater due to yield effects and the interaction of area and yield. In other words, if prices were to improve, both area and yields would rise. If output prices were unchanged, the supply of edible oils would have to increase at a rate of nearly 12 percent per year just to maintain imports at their present levels.

OILSEED PRICE POLICY AND THE DISTRIBUTION SECTOR

1. There are wide margins between the price of cottonseed oil and that of ghee, averaging 32 percent per year over the last six years. A significant share of these margins goes to the costs of processing, handling and transport.

2. The extraction rate for edible oil is on the order of 20 to 30 percent lower than comparable levels in the United States. The processing industry is divided into kohlus, mechanical extractors and solvent plants. There are several thousand kohlus and small manual crushers used largely to process rapeseed and mustard for village consumption. The mechanical expeller industry processes over 90 percent of the edible oilseed used for domestic ghee production, but efficiency remains low due to the lack of delinting facilities and the use of low-pressure, single-run crushers. After nationalization, solvent plants fell into a state of disrepair and, at present, are operating well below capacity.

3. The primary domestic source of edible oil is cotton, a crop produced primarily for its fiber with oil as a by-product.

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[1]Mohammad Ashiz, "Area Allocation Decisions: A Study of Pakistani Farmers' Responsiveness to Changes in Prices," Occasional Study, Punjab Economic Research Institute Publication 186, May 1981.

Less than 20 percent of the value of cotton is in the oil and oilseed cake. Consequently, edible oil production is largely dependent on the demand for cotton fiber.

4. At present, it is more profitable to produce industrial oil than edible oil. Refined cottonseed oil is sold by expeller plants to the GCP at a controlled price of 250 Rs per maund (40 kg), while one drum (45 kg) of "scrap" or "dirt" oil can be sold to soap factories for Rs 400. Procurement quotas for cottonseed oil are given to expeller plants, yet these operations, by crushing at a low efficiency, can divert a sizable share of their oil from refined to industrial use. Furthermore, a premium price is paid for high-oil cake--a livestock feed. This adds another incentive to keep the efficiency of the processing sector at a low level.

5. To stimulate efficient edible oil processing, linkages to the commercial livetock sector must be forged. Present control prices on milk and beef prohibit the commercial expansion of these sectors. The Pakistani milk price is $5.50 per 100 pounds compared with $13.20 per 100 pounds in the United States. Imports of heavily subsidized European Economic Community milk powder undercut the domestic production of milk. Beef prices are 80 to 95 U.S. cents per kilogram (10 to 13 Rs/kg), which place them at near world-low levels. Commercial poultry production had been rising at a rate of 25 percent in the 1970's. Dressed weight poultry is nearly twice as expensive as beef and about the same cost as mutton. Retail poultry prices are not controlled.

OILSEED PRICE POLICY AND THE IMPORT/EXPORT SITUATION

1. Vegetable oil imports have been rising at a rate of 15 percent per year since 1978 to cover the domestic supply-demand gap. Total imports of vegetable oil in 1982/83 are estimated at 530,000 MT which will account for 68 percent of total domestic consumption. Edible oil imports are nearly equally divided between concessionary U.S. soybean oil and Malaysian palm oil.

2. In 1981/1982, estimated costs of edible oil imports were 250 million dollars. These are the largest of the agricultural imports, although they account for only five percent of total Pakistani imports. Since 1978/79, edible oil import costs have risen at a nominal rate of only one percent per annum due to the sharp fall in world oilseed prices.

3. The port price of Malaysian palm oil is 25 to 30 percent lower than the domestic price of edible oil. In 1981/82, the cost of a ton of Malay palm oil was $480, while the cost of a ton of cottonseed oil in the Lahore market was $677. This difference in cost can be attributed to the domestic subsidies granted to Malay palm oil producers as well as to the relative technological underdevelopment of the Pakistani oilseeds sector.

4. The domestic control price of vegetable ghee is 70 percent lower than the domestic retail price of ghee in India. Although ghee exports are legally prohibited, a significant amount of trade is said to flow across the borders. Consequently, Pakistani foreign exchange is being used to subsidize consumption of ghee in India.

5. Pakistan's import policies have been loosened in the last two years to allow private trade in edible oils. Importers are allocated foreign exchange and are eligible for special credit subsidies. At present, the difference between the import price and the retail price of ghee allows for a profit of approximately $150 per metric ton. Accordingly, the private import of edible oils is perhaps one of the most profitable agribusinesses in Pakistan.

6. India purchases soybean oil at $410 per ton--nearly $36 less than the amount paid by Pakistan--because India purchases the edible oil in lots of 10,000 MT or more. Increasing the size of procurement lots could save Paksitan up to eight percent of the foreign exchange it expends on edible oil.

7. The Trade Corporation of Pakistan supplies the Ghee Corporation with edible oil at a price of Rs 6,698 per metric ton, which allows a profit of Rs 1,439 per metric ton. This profit is returned to the federal government and is then used in the next year's budget. The other major revenue source from oilseeds is the excise tax of fifteen percent levied on ghee factories. These funds are also returned to the federal government for general budgetary use. There is, at present, no system by which import tax levels are tied to the level of funding of production subsidies or research and development in oilseeds.

8. Pakistan's current accounts deficit widened from 990 million dollars in 1980/1981 to 1.39 billion in 1981/1982. A current accounts deficit of 1.5 billion dollars is forecast for 1982/83. Pakistan receives an estimated 45 percent of its exchange earnings from worker remittances. While remittances grew well in 1982 following the float of the Rupee, they depend on the health of the Middle Eastern economies. Elimination of edible oil imports, at present, would save Pakistan a quarter of the nation's current accounts deficit.

To stimulate oilseed production and to improve the efficiency of edible oil marketing, an improved pricing policy will affect the future development of oilseed production and marketing. These groups of pricing policy will be referred to as (1) price-positive, (2) price-neutral and (3) price-negative. For purposes of policy recommendation, it is suggested that a price-positive atmosphere be adopted through the institution of appropriate pricing and procurement mechanisms. For purposes of comparison only, the three alternative pricing scenarios and their probable consequences are presented:

Price-Positive

In this case, ghee prices are raised by, for example, five percent per year in real terms (against the consumer price index), and the domestic market is protected from the adverse effects of the international market by a series of import duties and licensing controls. Farmgate procurement prices should be increased by an equal amount (five percent) by indexing against the wholesale price index.

The rise in retail ghee prices would cause the growth in consumption of ghee to drop by 40 percent from present rates. The higher retail prices would encourage expeller operators to improve edible oil extraction rates and direct their operations away from industrial to edible oil purposes. A higher urban ghee price would encourage the construction of new solvent extraction facilities which would improve extraction efficiency in edible oil processing. A higher farmgate price would induce farmers to turn over more area to traditional oilseed crops and to experiment with new oilseed varieties.

Under this pricing regime, the domestic market remains insulated from the world market. However, this will allow a controlled inflation of the value of edible oils and oilseeds to the Pakistani economy, gradually bringing market prices more in line with domestic scarcities. As world prices for oilseeds increase, domestic price controls could be relaxed accordingly. Revenue gained from import duties and licensing fees for edible oil could finance research and development in oilseed production.

Higher real prices may mean some groups would not be able to consume as much ghee as they had hoped or expected. Consumer disappointment could be offset by early warning of price increases and by gradual increases, in real terms, spread throughout the calendar year.

Price-Neutral

A price-neutral policy would be one in which all price controls are removed from the edible oil sector. This would include the

abolition of the floor price and retail ghee price. The price of ghee would be allowed to move in accordance with the movements in the international price of edible oil.

It would be expected that in the long run, a highly efficient allocation of resources will result to meet the domestic demand for ghee. This will be accomplished by inducing the private sector to mobilize resources to substitute for imported ghee. The situation would result in continued imports at present levels, with an expected rise in domestic prices as the world market price begins to climb.

The major gains from this policy would be the administrative costs saved from dismantling the price control apparatus, and the expected improvement in production atmosphere as the private sector realizes the GOP's commitment to promoting free trade.

There are also negative consequences of such a policy. In the short run, it will be far less expensive to import edible oil than to produce it domestically. Consequently, inefficient producers may be forced out of the edible oil market before they have had the exposure to new production technologies. Furthermore, the world price for edible oils has moved in a highly volatile fashion over the past decade. Exposing the domestic economy to the wide fluctuations of the international market may be unwise considering the importance of ghee in the domestic consumption basket.

Price-Negative

The third set of policies is termed "price-negative" because it involves falling real prices for edible oil and ghee, rising consumption and stagnating production. The current GOP pricing policy has contributed to the development of a price-negative atmosphere by allowing the price of edible oil and ghee to drop relative to the prices of competing goods. This tends to discourage increased output of oilseeds as farmers' profits are held down by low prices. Marketing efficiency, likewise, is maintained at low levels as processors find it more profitable to produce industrial rather than edible oil. Finally, as domestic prices are in excess of import prices, the greatest profits are being made in the import of edible oils. This leads to a bulging import bill for edible oil as well as an unfavorable allocation of domestic resources as private sector investment is put into import/export activities rather than domestic production or processing.

Conclusion

An increase in edible oil production is a major development priority in Pakistan. Pakistan is blessed with the natural

resource base that makes possible the domestic production of a wide range of oilseed crops. A prerequisite to production advances is the development of an economic and technological atmosphere that promotes the production and distribution of these commodities. A first step in that direction would be the establishment of a pricing atmosphere that allows for reasonable returns to the producing and distributing community. Consequently, policy measures taken to move from a negative to a positive pricing atmosphere for edible oils and their products is a necessary first step in an edible oil development strategy.

SUGGESTED PROJECT ANALYSIS--COST OF RETURNS OF PRODUCING AND DISTRIBUTING CROPS AND LIVESTOCK PRODUCTS IN SELECTED AREAS OF PAKISTAN

In the report by Boykin,* dated 14 December 1982, a proposal is made to establish a farm and livestock management unit which would conduct periodic surveys and provide budget and enterprise information to policymakers, as needed. Boykin suggests conducting this survey and analysis procedure in several geographic regions of the Punjab. The project would be located under the administrative control of the Punjab Ministry of Agriculture and close ties would be established with the Livestock Production Research Institute at Bhadanager and the Crops Research Group. Generally, the proposals offered by Boykin are first-rate and should merit serious consideration by the Government of Pakistan and the donor community. Several amendments to these proposals are offered in this paper that may improve the scope and operation of a farm and livestock management unit.

Who will use the data?

In proposing such a unit, it is important to consider from the start the final users of the data. Generally, price policy is made at the national level; decisions on import subsidies, tax policies and release prices are all made at the national level. Occasionally, "price-policies" are adopted on a district level, although this rarely occurs in times of normal market operation. On the national level, the Agricultural Prices Commission has been given a mandate to prepare recommendations for the pricing of agricultural inputs and outputs. This weighty task requires the regular provision of a source of farm enterprise data. It is only logical, then, that at the national level a farm and livestock management unit be linked to the Prices Commission.

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*See Cavlin Boykin, "Livestock and Poultry Production and Marketing," in Part VI of this series.

Price policy, however, is not the only area where a farm management unit can have an effect. Matters such as evaluating the agricultural terms of trade, distribution of income, trends in wage rates and allocation of government serivces can all be improved by the use of farm management data. Accordingly, government agencies that would evaluate such things--notably the Planning Commission--should be involved in the formulation of the unit.

Is There a Base to Build Upon?

Several cost-of-production and farmgate returns surveys have been conducted in the Punjab. Many of these have been of the "one-shot" survey and write-up variety where linkages to government decision making and policy analysis are weak. Furthermore, funding for studies conducted with more regularity appears to be on a year-to-year basis, so the continuity of the survey frequently is disrupted by lack of funds. Some of the best cost-of-production work has been done by the Agricultural Econcmics Department at Faisalabad Unversity under the direction of Dr. Mohd. Chaudry. This work has recently been expanded to incorporate livestock budgeting as well, and those reports should soon be forthcoming.

The Faisalabad work provides a solid baseline of data with which to begin and should be built upon if at all possible. Unfortunately, the link between the Faisalabad work and government price and food policy analysis is nearly nonexistent. Those responsible for conducting and analyzing the survey at Faisalabad seemed to have little confidence that their data would be used for government policy analysis. Accordingly, it would be preferable to draw on the technical expertise of the university in constructing surveys, selecting field sites and obtaining enumerators while developing formal institutional ties within the government proper.

Expanding the Management Scope

As several consultants and researchers have emphasized, the major constraint on increased production and farmgate returns studies should help identify areas where improvements in pricing, budgeting and management can be made. However, there are other areas comlementary to food and livestock production where bottlenecks to increased development also occur. One of the most important of these is the distribution sector. Often, the complaint is heard that the distributional inefficiencies in the food and livestock sector are so great that any positive price policy will be swallowed up by traders, leaving little for the farmer and less for the consumer. In many instances, products travel through a great number of hands, each taking a share of the final price. Losses in storage, transit and handling also can account for a significant share of the price buildup. In addition, inefficiencies in product distribution inhibit the efforts of

production campaigns.

As a first step in the amelioration of those constraints, the distributional inefficiencies must be identified and explained. Cost of production, business returns and market flow analysis can logically be linked with farmgate budget analysis to provide a more holistic view of the financial structure of the food and livestock sector. Accordingly, an additional component to the crops and livestock management unit would be a distribution analysis team. This team would select certain crops and animal products and, through a variety of survey techniques, identify the costs and returns at various market levels and the constraints to improved distribution efficiency. What follows is a proposed project that builds upon that suggested by Mr. Boykin in his report of 14 December 1982.

Technical Description

The project would involve the development of a crop and livestock management unit with a mandate to develop a system of farmgate and market surveys to provide data for policy makers and other users. The unit would be jointly administered by the Prices Commission and the Federal Department of Agriculture. A provincial office would be established in the Punjab in coordination with the Provincial Agriculture Department. The linkages between the project and the Agricultural Planning Commission would be strengthened through exchange of manpower and the establishment of overseas training programs for commission staff.

The unit would conduct farmgate and market surveys in six to eight agro-climatic regions of the Punjab and report on a regular basis. Emphasis would be placed on (1) developing suitable interviews and interview procedures, (2) supplying a timely source of information, (3) linking the information produced to those who are in a position to use it and (4) responding to requests for additional information as is possible within the mandate of the office. Training in survey procedures, data analysis and report preparation would be included in the project. After a trial period of no less than four years, plans would be drawn for the extension of the unit to other provinces.

To staff the unit, early emphasis would have to be placed on the use of expatriate staff. Following Boykin, it is suggested that a project leader, crops economist and livestock economist be hired as contract officers. In addition, a marketing economist would be required to provide the expertise needed for an analysis of food distribution. To synthesize and coordinate various informal survey activities, it is suggested that a sociologist be recruited for project staff. At least half the project staff's duties would consist of transferring knowledge and experience to Pakistani counterparts.

To initially assist in surveys and analysis procedures, statistical and computer science support would be required. It is

suggested that during the first two years of the project, statistical and computer science consultancies be included in the project budget. These consultancies would be for at least six months each.

With an expanded professional staff, the enumerator staff and the counterpart personnel (relative to the Boykin proposals) can be expanded. Counterpart scientists should equal the number of expatriates—that is, five, and the enumerator staff should be increased to at least 30.

As the project expands, the most promising of the counterpart staff would be used as a cadre for setting up management units in other provinces. Building and equipment needs would include space and equipment, field enumerator housing, motorbikes, trucks and supplies and housing for expatriate staff.

Evaluation and Benefits

The evaluation framework and the project benefits would be essentially the same as those defined by Boykin, except for a marketing component that would also be subject to review. It would be useful if the marketing studies were reviewed by members of the Provincial Food Department and by PASSCO because both are heavily involved in marketing assessment. In addition, private sector review of marketing studies from agribusiness concerns would be another means of improving the research and reporting process.

The policy implications, the social implications and the implementation framework would be similar to those defined by Boykin for a marketing component that would be included. This would add considerable scope to the reports provided by the unit because questions of marketing margins, inefficiencies in the distributional sector and marketing laws and procedures could be based on a set of data that would be, at the least, consistent with a set of farm accounts. While all empirical studies have their limitations, the establishment of a proper statistical reporting service (on the lines of the Indian Statistical Authority) that links farmgate budgeting with the analysis of marketing practices would be a proper base on which to establish agricultural policy and to conduct extension services.

The fiscal plan and budget suggested by Boykin would be modified only to include the marketing component and to account for additional staffing requirements. This revised budget is provided below.

Fiscal Plan (Donor Contribution)

($ U.S. 1,000)

Professional Staff	Total	Years 1	2	3	4
Project leader (farm and livestock management)	600	150	150	150	150
Farm management economist (livestock)	560	145	145	145	145
Farm management economist (crops)	580	145	145	145	145
Marketing economist	580	145	145	145	145
Sociologist	580	145	145	145	145
Consultant--computer scientist	140	70	70	-	-
Consultant--statistics	150	75	75	-	-
Training of counterpart staff	240	60	60	60	60
Overseas training of price commission staff (4)	360	90	90	90	90
Microcomputers and software	35	35	-	-	-
Trucks (3)	60	60	-	-	-
Petroleum	12	3	3	3	3
House, furniture, equipment	-	-	-	-	-
Expatriate housing and airfare	-	-	-	-	-
Office operating expenses	-	-	-	-	-
TOTAL Donor Contribution	3917	1123	1028	883	883

Fiscal Plan (Pakistan Contribution)

Staff and Supplies

1. Counterpart scientists (5)
2. Enumerator staff (local) (30)
3. Clerks (local) (3)
4. Computer operators (2)
5. Drivers, typists and others (5)
6. Office facilities
7. Electricity, fuel, phone facilities and allowance
8. Staff for overseas training (4)

SYNOPSIS

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SUPPLY AND PRODUCTION OF EDIBLE OILS

Cottonseed is the principal oilseed crop, accounting for about 80 percent of Pakistan's edible oil production. Cotton acreage increased slightly in 1982 from 1981/82 levels, although total output continues to hover around 1.4 million metric tons. Rape and mustard seed production are estimated at 250,000 metric tons--only a slight increase over 1979/80 levels--while peanut and sesame levels remain at the previous year's level. The GOP's oilseed production strategy has not yielded encouraging results during the past five years, and the main sources of oil continue to be the traditional crops--cottonseed, rapeseed and mustard seed. Significant advances in edible oil production will come from the expansion and development of the nontraditional oilseeds--sunflower and soybean--and to a lesser extent, peanut.

Linear programming analysis has demonstrated that, at present pricing levels, the nontraditional oilseeds can compete successfully for land and labor resources without displacing any of the major food crops. A substantial amount of land that is idle after rice, fallow after cotton or is alongside riverbeds, may be used for the production of sunflower, soybeans, safflower, rapeseed and mustard. Barani areas of NWFP and Baluchistan show considerable promise for the production of groundnuts.

At present, sunflower suffers from the shortage of inexpensive threshers and peanuts from a shortage of suitable diggers. A machinery program to supply these needed tools would aid in the promotion of both these crops.

A major increase in the production of hybrid sunflower, soybean and safflower seeds will be required to meet the needs in increased plantings. By 1988, the estimated area for planting seed production would be sunflower, 11,250 hectares; soybean, 25,000 hectares; and safflower, 18,750 hectares. The development of a hybrid seed industry is a priority in supporting a promotional campaign for the dissemination of new varieties.

Soybean production suffers from low germination rates. The development of suitable inoculum for soybeans and groundnuts would improve the performance and enable the production of these crops under more secure conditions.

Research into new varieties and the adoption of existing varieties is conducted by several institutions in Pakistan. Research is still insufficient to support an extensive nontraditional oilseeds campaign and, particularly in the area of agronomic support, considerable attention should be paid to improving present capabilities.

There is an abundance of resources available for an increase in the production of edible oils. Increases in the production of new oilseeds need not replace production of major crops because millions of acres of dobari or rice-fallow land, cotton-fallow

land and kacha land are available. From 30 to 50 percent of these lands are cropped, often with very little input or care. Of the estimated 6.75 million acres of these lands, an estimated 3.5 million acres could be planted to one of the nontraditional oilseed crops.

Production function analysis using research station yields suggests that at present pricing levels, optimum farm yields for rapeseed would be 1.4 tons/hectare; soybeans, 2.6 tons/hectare; safflower 1.04 tons/hectare; and sunflower, 1 ton per hectare. These yields are nearly twice the level presently obtained on farmers' fields, which suggests that the marketing sector is not providing a proper pricing signal to farmers. These yields are also less than half the maximum research station yields. It follows that the gap between the top research station yields and the farmers' fields is on the order of 200 percent, and that nearly half the gap can be explained by the uncertain marketing environment for these crops.

DEMAND FOR EDIBLE OIL IN PAKISTAN

Consumption of vegetable oil-vanaspati has increased rapidly over the past decade. The gain reflects the expanding domestic demand due to rising real consumer incomes and continued rapid growth in population. In addition, retail prices for vegetable oil products rose much less than the general price level resulting in sharply declining real prices for these oils.

Vegetable ghee consumption has been increasing at a rate of nine percent per year during the past five years. During that time, real vegetable ghee prices have dropped an average of seven percent per year. Simultaneously, there has been a significant shift in consumption from a milk-based to a vegetable-based ghee. In the early 1970's, desi ghee, by weight, was nearly twice as expensive as vegetable ghee. By 1980, desi ghee was three times as expensive as vegetable ghee and consumption is stagnant.

All estimates indicate that demand for vegetable oil products will continue to increase at a rate of seven to ten percent per year. Demand can be managed through rationing, shortages and pricing policies. The first two alternatives are politically unfeasible, while the third is difficult due to the attractive price of imported oil. However, even if the GOP enforces a five percent real increase in ghee prices for the next ten years, ghee consumption will still be 30 percent higher in 1990/91 than in 1980/81. At present, retail ghee prices in Pakistan are 80 percent lower than retail ghee prices in India. While inexpensive ghee prices can be rationalized in terms of consumer utility and the provision of a basic staple to a broad population group, the costs in terms of rapid demand expansion and foreign exchange are great.

TRADE

Vegetable oil imports have been rising at a rate of 15 percent per year since 1978 to cover the widening supply-demand gap. total vegetable oil imports for 1982/83 are estimated at 530,000 MT, which will account for 68 percent of domestic consumption. Edible oil imports are nearly equally divided between concessionary U.S. soybean oil and Malaysian palm oil, although projections for next year have the soybean/palm oil import mix at 40 to 60 percent.

The port price of Malaysian palm oil is 25 to 30 percent lower than the domestic price of cottonseed oil. In 1981/82, the landed cost of Malay palm oil was $480, while the cost of a ton of cottonseed oil in the Lahore market was $677. At present, this difference in costs allows for a profit of nearly $140 per metric ton of imported oil.

The total cost of edible oil imports in 1981/82 was estimated at U.S. $280 million. Hard currency payments are only two-thirds of this due to the subsidy element in soybean imports. After defense and POL imports, edible oil imports are the next largest user of foreign exchange. From 1980/81 to 1981/82, Pakistan's current account deficit widened from 990 million to 1.39 billion dollars. The chronic balance of payments deficit makes the reduction in oilseed imports an absolute priority in overall economic development management. The largest savings in foreign exchange would come from a reduction in Malay palm imports as they involve the largest allocation of hard currency reserves. Under the most optimistic production and demand management forecasts, it will be difficult for Pakistan to reduce the present levels of edible oil imports in the near term.

A successful edible oilseed campaign should be judged by the ability to offset future expansion in imports and the reduction in hard currency payment for the imported oil. The 40 percent nominal decline in international edible oil prices over the past three years is due to the expansion of palm oil production in Malaysia and Indonesia and the development of soybeans in Brazil, Argentina, India and Spain. There are indications that buoyant world supplies of edible oil will continue in the near term, although long-term prospects would include a strengthening of the price in international markets as acreage and production are cut back.

LIVESTOCK

The livestock-feed sector is directly related to oilseed development through the production of animal fats, use of oilseed by-

products and the competition of oilseeds and feedstuffs for production resources. Feed concentrate supplies consist mainly of by-product feeds such as bran; molasses; milling products; some grains such as maize and small quantities of wheat and rice; and the cakes and meals of cottonseed and rape/mustard seed. Small quantities of feed are imported and some are exported. Feed concentrates have increased little in the past decade, while the output of the concentrate-using animals--mostly poultry and to an extent, cows--have increased rapidly.

From 1972/73 to 1980/81, poultry production increased more than threefold; output of improved eggs increased 4.5 times; and output of all eggs was up nearly fourfold. Milk production, based mainly on roughage feeds, increased approximately 15 percent over the decade. Rapid gains for sheep and mutton may be partly at the expense of the output of cattle/buffalo which increased much more slowly. But many of these animals are used as draft animals and they eat mainly roughage and some oil cakes.

For beef and cows meals are not now used for feed. The low, controlled wholesale price for beef and milk makes the use of high-protein feed rations unprofitable. For milk, low prices are, in part, maintained by the import of low-cost, subsidized powdered milk from the EEC. Dairy production suffers from low productivity per animal, use of unbalanced rations, poor genetic quality of existing stock and difficulties in maintaining fluid milk standards. For beef and dairy, stock reduction, the long-term genetic upgrading of herds and the establishment of a usable set of product grading standards will encouarge the use of higher quality oilseed meal-based feeds. In addition, economic returns for sheep and goat production in Paksitan are high, although at present there is no organized feed industry for these animals.

The potential market for oilseed-based feeds is strong in poultry. The potential for output of poultry products will depend mainly on the supply and price of feedstuffs. The strong feed demand from poultry will become the dynamic demand force, driving the market for high-protein meals and sources of energy. Output of poultry products may already be at the limit of available feed concentrate supplies, especially of high-quality feedstuffs.

For poultry, current levels of poultry management and disease control result in extremely high mortality rates, averaging 30 percent in commercial layers and 15 percent in broilers. Seasonal declines in egg consumption during summer months result in seasonal sell-offs and replacement of laying flocks. This creates price increases during high demand periods and consequent setting of poor quality eggs and hatching of poor quality chicks. Lack of feed standards and inadequate laws regulating feed quality result in uncertain quality feed being sold to the poultry producer.

It is most difficult to assure a balanced ration free of molds and aflatoxin. To improve the poultry sector, programs of

technical assistance, cooperative research, and training abroad of poultry and farm managers should be initiated. Establishment of egg processing plants and poultry meat processing plants will also aid this sector. Finally, the establishment ano enforcement of mixed feed standards will greatly assist the development of the commercial poultry sector while ensuring a market for high-quality oilseed meal.

PROCESSING

Demand for poultry meal will have an initial effect on the improvement in processing efficiency in Pakistan. The processing sector can be divided into oil extraction and the refining of the oil into ghee and liquid blended oils.

Kohlus, low-pressure expellers, and solvent plants are used to crush the oilseeds and extract the oil. Kohlus process 50 percent of the domestic rapeseed and mustard--approximately 40,000 tons of seed used for domestic consumption and retail sale. Under eight percent of cottonseed is processed by solvent plants. There are 13 salvageable solvent plants operating at 13 percent of their capacity, which is estimated to be 380,000 tons of seed.

Low-pressure expellers are, by far, the most economically viable means of processing cottonseed and the other edible oils. Their processing efficiency for cottonseed is estimated to be 11 percent, while solvent plants could technically reach 16 percent recovery levels. Loss of oil due to expeller processing in 1981/82 is estimated to be on the order of 50,000 tons of oil. However, the operating cost of the expeller plants is nearly half that of the solvent plants, which explains the use of low-pressure expellers for processing cottonseed.

In 1981/82, most of the sunflower crop was crushed by the solvent plant, Solvex of Multan, under contract to the GCP. Sunflower is primarily an "oil" crop since about two-thirds the value of sunflower seed comes from the value of the oil. The crop has the potential to produce the highest oil yield per acre in Pakistan. Sunflower also requires the least solvent capacity per ton of oil extracted of any of the major or potentially major oilseeds. Expansion of the sunflower industry would help to revitalize the solvent-processing sector due to the demand for high quality sunflower meal.

There are 26 publicly owned and operated ghee plants and five plants in the private sector. At present, seven plants are under review for denationalization. It is estimated that the operation of a public sector plant is 25 percent more costly than the operation of a private sector plant and that public sector plants use nearly six times more labor than do the private sector plants. Problems of accrued debt, a large labor force and poor maintenance inhibit the rapid denationalization of the ghee

plants. Private sector interest in ghee plants and blended oil processing is high and represents a viable means of upgrading the capabilities of the edible oil industry.

The margin between the farmgate price of seed and the final ghee price is approximately 45 percent. This is a high margin and reflects the long chain of government intermediaries that handle edible oil, the 15 percent excise tax and the normal marketing charges. The large margin hides the low returns paid to crushers and expellers for the initial extraction of oil. A low procurement price for cottonseed and the other edible oils enables the low-cost, low-pressure expellers to operate profitably but inhibits the use of solvent facilities.

A higher procurement price for oilseeds would enable the solvent facilities to profitably crush a larger volume of oilseeds. To bring the solvent plants into capacity for sunflower and soybeans would require an investment of approximately one million dollars per plant for delinting, dehulling and other preparation equipment. Higher extraction rates from these plants would more than cover the foreign exchange cost needed to bring them into production.

MARKETING

Problems in marketing nontraditional varieties represent a major impediment to the development of the oilseeds sector. At present, cotton is sold to ginners who, under GCP supervision, sell the seed to low-pressure expellers or solvent plants. Processors then turn over their refined oil to the GCP at the fixed price of Rs 269.50/kg. The oil is then processed by the GCP into ghee. The Trade Corporation of Pakistan (TCP) also imports soybean and palm oil to be used by the GCP to make ghee.

Rapeseed and mustard seed are primarly processed by kohlus (stone seed crushers) and low-pressure expellers. Either the farmer or a broker (beopari) will bring the seed to the crusher where it will be crushed for a fee of approximately Rs 1/kg. The farmer then obtains the oil and the cake. Probably less than 20 percent is actually marketable surplus and enters into the small town markets (karyana).

For the nontraditional oilseeds, procurement and marketing is conducted by the GCP. Field supervisors of the GCP establish forward contracts with growers for procurement of the new oilseed crops (sunflower and soybean). Seed and technical advice are supplied by the GCP to the growers and, after the harvest, the GCP arranges for the pickup of the crop. The cost of transport and gunny bags is provided by the GCP. After the crop is picked up, it is delivered to a GCP procurement center where it is weighed and graded. A payment order is then sent to the GCP's regional officers and a check is issued to the grower. Growers

frequently complain of late payment, untimely procurement, underweighing, nonpayment of transport costs and inadequate technical advice. Many cite the absence of a guaranteed market as a reason for limiting their exposure to nontraditional oilseeds.

The marketing system for the nontraditional oilseeds does, in practice, bypass the traditional regulated marketing system of middlemen (beoparis), commission agents (arthis), wholesalers (dukandars) and retailers (karyana). Recent investigations have shown that the private sector is far more competitive and efficient in marketing food than the government.

For several food commodities, it is estimated that the cost of the government procurement and distribution system is 10 to 50 percent more than that of the private sector marketing system. Improvements in the marketing system for nontraditional oilseeds can be made if the GCP subcontracts procurement with private traders. If the GCP were to appoint authorized dealers to procure sunflower and soybean and offer them an attractive commission of about four to five percent, the difficulties in procurement and marketing would be rapidly eliminated.

INSTITUTIONAL SUPPORT FOR EDIBLE OIL DEVELOPMENT

Institutional support for edible oil expansion is limited by a shortage of resources, staff and organizational guidance. Agricultural extension services for the traditional oilseeds are almost nonexistent, while cotton in high producing areas does receive the benefit of extension services. Nontraditional oilseeds have extension programs administered by the GCP which does offer better service than the agriculture department extension service, although GCP is severely under-staffed in this respect. Cooperative production and marketing has been found to be a viable means of operation in Pakistan. At present, however, there are no marketing cooperatives for oilseeds and few prospects that any will come into existence.

Numerous research institutions are conducting oilseed trials and station yields are encouraging. There is, however, a wide gulf between the research stations and the extension cadre that must bring the message to the fields. Preliminary evidence from the IBRD-sponsored training and visit extension program suggests that more effective means of reaching the farm community may develop.

A variety of organizations are involved in edible oil production and distribution. The Trade Corporation of Pakistan is the agent for all state imports and must sanction private oil imports. The Ghee Corporation handles the procurement and promotion of all nontraditional oilseeds and controls the vast bulk of all ghee production. The Oilseed Development Board, a federally constituted body, has a regulatory and promotional mandate for edible oils but as of yet no staff. There is a great need for an

effective edible oils authority capable of directing production campaigns, controlling trade and setting and enforcing quality standards in the oilseed industry. Recent experience suggests that private sector participation and leadership of such a body would promote the most successful organizational form for the promotion of the oilseeds sector.