EGYPT

Strategies for Accelerating Agricultural Development

ANNEXES TO

A REPORT OF THE PRESIDENTIAL MISSION
ON AGRICULTURAL DEVELOPMENT IN EGYPT

Ministry of Agriculture of the Arab Republic of Egypt
and the U.S. Agency for International Development
in cooperation with
The International Agricultural Development Service
U.S. Department of Agriculture

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FOREWORD

This publication contains papers written by members of and consultants to the Presidential Mission on Agricultural Development in Egypt. Although they complement the official report of the Mission, they are the responsibility of the individual authors and have not been reviewed by other members of the Mission.

EGYPT: STRATEGIES FOR ACCELERATING AGRICULTURAL DEVELOPMENT

ANNEX A

A SCENARIO FOR AGRICULTURAL POLICY ADJUSTMENTS IN EGYPT

By

Edward Schuh, Chairman, Department of Agricultural Economics, University of Minnesota

ANNEX A: A SCENARIO FOR AGRICULTURAL POLICY ADJUSTMENTS IN EGYPT

If climatic conditions are taken into consideration, Egypt has one of the richest endowments of agricultural resources on the African continent and possibly world-wide. Yet this nation is not taking advantage of these resources to further its own economic development. Discriminatory trade, exchange rate and price policies undervalue these resources for development purposes by a considerable margin. By the same token, Egypt has failed to capitalize on new production knowledge from the world economy that is available to it at virtually zero cost.

It is not new to Egyptians to hear that their food subsidies are high and that the prices paid to farmers are low. Egyptians themselves know it, and certainly many foreign observers have noted the extent of the distortion in relative prices.

Less seldom, however, does one hear clearly articulated statements of the consequences of these distorted prices. I believe it might be useful to attempt such an articulation as part of the on-going debate over the country's agricultural development strategy.

There are a number of ways one might approach the problem. Perhaps the obvious place to start is with income-distribution issues, since there are strong income-distribution considerations in the present set of policies.

Egypt is to be commended for distributing the benefits of its economic development on a reasonably equitable basis--in fact, for a rapid growth economy, the distribution has been possibly as equitable as that of any country in the world. Moreover, I would not question this goal since each country makes its own choices. What can be questioned is

the way in which the distribution of income has been altered. In Egypt, the price system has been used as the primary means of taxing the agricultural sector and of distributing income to consumers. The problem with this is that the price mechanism is a very inefficient means of doing either one of them. On the production side, it has serious output-depressing effects, thereby eventually killing the "goose that could lay the Golden Egg." On the consumer side, it distributes benefits capriciously to one and all rather than to the truly needy, while at the same time inducing an inefficient use of the nation's resources.

Given that equity is such an obvious consideration in present pricing policies, it might be worth examining some of the obvious equity consequences of the current system. Lowering food prices obviously shifts the relative distribution of income in favor of the poor. Most societies would have little quarrel with such a switch if resources were available to do it. But although the poor benefit in a relative sense, it is also the case that upper-income groups benefit more in an absolute sense, since they consume larger total quantities of food. Is that what society really wants? With a given amount of resources to redistribute, does it really want to redistribute it among rich and poor alike? Or would it prefer to concentrate what limited resources it has on the truly poor?

Consider also the Egyptian producer. Almost every country in the world siphons resources out of agriculture to further its development process. Again, there can be no quarrel with that since at early stages of development, the bulk of a nation's resources are in the agricultural sector. But one can question the way resources are taxed away from the agricultural sector. There are ways that resources can be removed from agriculture without the strong disincentive effects of the present system.

Returning to equity considerations, one can well agree that those in the agricultural sector should have their income lowered relative to those in the non-farm sector. But if equity is such a strong consideration, does it really make sense to pay foreign producers a much higher price than domestic producers receive for the same product? And most especially, does it make sense to so strongly favor the foreign producer if in the process the aggregate rate of economic development for the economy as a whole is sacrificed? The important point to be made in this context is that the price system is a poor way to redistribute income, but an effective way of obtaining an efficient allocation of resources. An overriding policy goal in the near to short-term future should be to disconnect the price system from its present income-distribution objectives and shift it in the direction of efficiency so as to obtain a more effective allocation of resources.

Efficiency often sounds like an abstract concept. What does it really mean for a country like Egypt as it moves through the 1980's? Egypt's political power on the international scene will be largely determined by its economic power. It is economic power that will enable it to sustain a strong defense; it is economic power that will enable it to influence its neighbors, and it is economic power that will enable it to provide for its own citizens.

Economic power is rooted in higher rates of economic growth and development. One can look back and say that the eight-to-nine percent growth rates of the recent past have been unusually good on a world scale. But what if those growth rates had been twelve percent? How much better off would Egypt's people have been if its growth rate had been higher? The answers are obvious.

More efficient use of the nation's resources is the key to obtaining higher growth rates. It is the reason that efficiency prices are so important, for it is only in the presence of appropriate price signals that maximum advantage can be taken of Egypt's unusual resource endowment.

Efficiency prices for agriculture involve a number of different issues. In the first place, prices to producers should reflect the international opportunity costs that Egypt favors in the international economy. It should be emphasized that this involves more than getting domestic producers prices up to a level consistent with border prices. It also involves getting the ratio of agricultural to non-agricultural prices consistent with the ratios at which those same goods trade in the international economy.

Secondly, prices that consumers pay should be consistent with what producers are paid. In that way consumers will pay the same costs for their consumption basket as the incremental cost of either producing those goods at home or of importing them. To set consumer prices at any other level is either to tax consumers or to subsidize them. In either case economic wastage is the result, with a consequent sacrifice of economic growth and development.

It is simple enough to state what the objectives of price policies should be. It is quite another to move from the present set of price ratios to the desired set. The income-distribution consequences of such a shift will be large. If these are not handled well, political disturbances can easily lead to retrogression in the pursuit of the desired policy and possibly the loss of power of the incumbent government.

Caution is obviously required in shifting to a new set of price relations. But I believe that with strong political leadership, it can be done. Political leadership will require that the goals of policy be clearly articulated and the rationale for the shifts made clear.

An important characteristic of the present system is that income is being redistributed in implicit ways. Producers are being taxed in implicit ways by being paid at less than the international-opportunity costs for their products. Consumers are receiving implicit subsidies by virtue of being able to pay artificailly low prices. Hence, an

important share of the income that is redistributed never passes through the Federal Treasury.

An important element of changing the system is to make these taxes and income transfers explicit. That is inevitably necessary if prices are to play their true allocatory role. It will also eventually lead to a more reasoned political choice as to whether these are really the income shifts that society wants.

Translating efforts to make income distribution explicit into policy actions means two things. First, one would want prices to reflect true scarcity values. Second, income transfers are connected to explicit forms. For the producer, it would mean that he would begin to pay, say, an income tax or a land tax. For the consumer, it would mean that rather than low consumer prices, he would receive an explicit income supplement from the government. In principle, one could make these changes without altering the present distribution of income. Politically, it might be desirable to try to move more rapidly.

The logical place to begin is on the producer side. Liberalization of prices to farmers should lead to significant increases in output. These increased in output will make it easier to deal with the consumption side of the problem. They will also make it possible to import less food. A reduction in the import bill will help strengthen the Egyptian pound, thereby helping to offset some of the inflationary effects of the price increases for agricultural products. They will also free up foreign exchange to purchase other imports required for the development process.

It is important to recognize that agricultural output will increase from a number of sources. In the first place, there will be the usual response from moving up the supply curve. This response may not be very large in the short run, and policy makers should not expect too much. But it should not take more than two or three production periods for

the commodity mix to shift and for farmers to begin to use their own labor and land more intensively.

Over the longer term, the production response could be quite substantial, especially if the recommendations to strengthen the agricultural research and extension services made elsewhere in the Strategy for Accelerated Agricultural Development (SAAD) report are heeded. Under these circumstances the new knowledge on the world scene will begin to be adopted, and output response of forty to sixty percent may eventually be obtained.

The liberalization of producer prices can obviously bring some significant benefits, especially if patience is exercised and prices are sustained with persistence. However, parallel measures are required at the same time. The increase in producer prices means that the acquisition of resources by the government from the agricultural sector will be more expensive, if resources are to be acquired in-kind. Moreover, the implicit income transfer that the previously distorted prices represented will no longer be available. Hence, a larger explicit resource transfer will be needed.

The need for larger explicit resource transfers to offset, at least to some extent, the decline in implicit transfers suggests that the land tax be increased at the same time that producer prices are liberalized. An income tax could be just as effective in mobilizing resources, but there are strong reasons for preferring the land tax. In the first place, such a tax has a minimal resource allocation effect if it is set at levels no higher than to extract the Ricardian rent. In the second place, it can be defined in such a way as to be very similar to the present procurement system, which will facilitate its adoption. And in the third place, it will limit the large capital gains that present land owners might receive from increased prices, thereby minimizing the political problems associated with price liberalization.

An important corollary policy required to go along with the implementation of a land tax is to break the linkage that now exists between the level of cash rents and the present land tax. In my judgment that linkage should be broken in any case. It is not clear without further analysis at what level the land tax should be set. That will depend in part on what is done on the consumption side. However, the calculation of the tax required is possible. It would not be difficult to ascertain, for example, the level of explicit taxation that would be roughly equal to current levels of implicit taxation. With a significant output response from price liberalization, the level of the explicit tax could be set even higher while still leaving producers better off than they are at present.

The advantage of a land tax is that it has no disincentive effects, if properly set, in sharp contrast to the present system of taxes. To gain acceptance for the idea, it would be important to articulate to producers that the level of taxation is not being changed, only its method of collection. If the tax is well-designed, policy makers would be able to obtain the output-increasing effects without providing large capital gains to producers. The tax could be collected in-kind or in cash. Eventually, it would be desirable to move to a system of cash payments, although during the transition period there may be advantages to collecting it in-kind.

Other policy changes should be made on the producer side at the same time that producer prices are liberalized and the land tax imposed. For example, the prices of fertilizer and energy could be moved to their international-opportunity costs as well. And interest rates for credit should be set at levels consistent with the incremental cost of supplying credit to the sector. Given the nature of the adjustments required, efforts should be made to move all price relations to their proper ratios at the same time.

The most severe political difficulties of any adjustment scenario are likely to be encountered on the consumer side. Hence, it is wise to move with caution. The ultimate objective should be to move consumer prices to a level consistent with the prices that producers receive or to that at which the commodities are imported and to convert implicit income transfers to explicit income transfers. To do this may require a significant change in wage policy, and this may be the most difficult part of the transition process. Ultimately, nominal wage rates will need to reflect the higher costs of food, if the real wage rates of workers are to remain unaltered.

From the perspective of the employing sector, the increase in nominal wage rates, of course, will be an increase in real wages. Hence, in the short term there will be significant income losses in the producer sector, even if the level of real wages remains unchanged to the worker. I will return to this point at a latter stage.

Given the political significance of the one piaster loaf of bread, there may be merit in retaining some aspects of this policy through the transition, although upward adjustments in the cost of this bread should be started immediately and repeated on a scaled basis through time. Something like a food-stamp program should replace the remainder of the food subsidy, with the cash value of the food stamps roughly approximating present food subsidies.

Raising producer prices and import prices to their true scarcity value will mean that the cost of providing the consumer with the present subsidized market basket will increase substantially. It is probably unrealistic to expect that the government would be able to compensate all members of society for the loss in income associated with a return to incentive prices for agriculture. For that reason it is perhaps best to use both wage policy and some type of food-stamp program jointly.

Policy decisions will be required to determine both the population

groups eligible for the food-stamp program and the amount of income to be provided. These are ultimately political decisions. However, I would suggest that attempts be made to support the incomes of those whose incomes are in or near the bottom 25 to 30 percent of the distribution. However, it would probably be unrealistic to attempt to match current consumption levels since these reflect highly subsidized prices. A more appropriate approach would be to try to provide adequate nutrition at the changed-price relations, given the income this part of the population receives.

Two other elements are required in moving to a set of true scarcity prices on the consumer side. First, wages should be raised for people in the public sector to compensate for the increase in food costs. Second, some way needs to be found to compensate the private sector for paying higher wage rates. This can be handled either by a tax exemption, or by a direct subsidy on the payroll--a counterpart to the more familiar payroll tax.

A number of points should be kept in mind in implementing those policies. First, it is unrealistic to attempt to compensate all losses on the wage bill. The administrative burden would be too great. A policy decision would be required regarding the size of firm to compensate. A useful rule of thumb might be to attempt compensation for all employers hiring five or more workers.

Second, it is unrealistic in the short term to expect wage adjustments that would fully compensate the previous market basket at the new price levels. The best that can be done is to attempt to reduce the income losses for the bulk of the population. Political leadership of a high order will be required during this period, with clear articulation of policy goals and expected consequences repeatedly stated.

Finally, wage subsidies should be gradually phased out over time. A three-year transition period would appear to be appropriate. The length of the transition period and the amount of the wage subsidy

should be clearly articulated from the beginning. Perhaps the goal should be to offset seventy-five percent of the increase in wage costs the first year, fifty percent the second year, and twenty-five percent the third year.

These proposals for handling the transition to true scarcity prices for the consumer will obviously have important budget implications. The shift from implicit subsidies to explicit subsidies will require an increase in budget expenditure. Added to this will be the increase in the wage bill for the public sector and the direct subsidy on the wage bill for firms in the private sector.

There are two important means of dealing with these increases in fiscal costs. First, the land tax on agriculture or something equivalent to it is imperative. If the output response to higher prices is substantial, the tax take could be substantial. The need to have a larger supply of fiscal resources is one reason why policy-makers should move with dispatch to implement the technology programs suggested in the SAAD report. The combination of sound technology programs and proper price incentives should bring about a significant output response.

It should also be recognized that present concumption levels may be deceptive as a guide to policy. Consumption levels have increased rapidly in recent years in part because of the significant decline in the real price of food. If more realistic prices are effectuated in the market place, consumption levels for food can be expected to decrease.

There will also be help from other sources. Proper incentive prices to farmers should lead to an important increase in the demand for labor from agriculture. This increase in demand will come in part from an intensification of production with the current commodity mix. In addition, a liberalization of prices might realistically be expected to lead to a more labor-intensive commodity mix, with a shift out of forage crops to cultivated crops and a heavier emphasis on labor-intensive

fruits and vegetables. This increase in the demand for labor should help keep strong upward pressures on wage rates throughout the economy, thereby helping to offset in some measure the losses in income due to higher food costs.

A major change should take place in the use of commodities provided by the PL-480 and the Commodity Import Programs (CIP). Currently, both of these programs have enabled the government to avoid facing its pricing problems in the food and agricultural sectors. Realistically, one cannot expect either of these programs to continue indefinitely into the future. Therefore, both of them should be used to help achieve the transition to a more appropriate set of price policies, and eventually to complete economic independence.

How can that be done? In the first place, the commodities should be released into the economy in such a way as to have minimal disincentive effects. The easiest way to do that is through income transfers to low-income groups in society. In that way the increased supply of food which the increased imports represent will also be increasing demand. By moving on both sides of the market, there should be minimal price disincentive effects.

The second way the PL-480 and CIP commodities can be used to help get through the transition period is to use them as integral elements of the government's fiscal resources. In this way, they can help alleviate any cash flow problems that arise from implementing the land tax on agriculture. They also can simply count as part of the government's fiscal resources.

I see at least three ways that the PL-480 and CIP commodities can be used as fiscal resources in the transition. First, they can be used directly in the food-stamp program. The food stamps will provide a certain real income equivalent of food to low-income groups. During the transitional phase the concessional commodities can be provided

to them in-kind. Finally, the wage subsidy to the private sector might also be provided in-kind. In that way, the firms in the private sector could in turn provide at least part of their wage increases in-kind.

Finally, a significant part of the PL-480 shipments could be used as a means of increasing the schooling rate in both the rural and urban areas. One way to do this is through school-lunch programs. Literacy and skill levels are presently low in the Egyptian economy. The transition to a modern industrial society requires a general improvement in cognitive skills among the population and an increase in skills useful to a modern industrial economy. Even in agriculture, the adoption of modern, high technology agriculture requires an increase in cognitive skills and an increase in other vocational skills.

Perhaps the most important cost of schooling and the acquisition of vocational skills in a low-income country such as Egypt is the income sacrificed in acquiring such schooling and vocational training. In rural areas, children are needed to work to produce the subsistence level of living, although essentially the same thing happens when low-income families move to the city. Children also engage in marginal work activities to help earn the subsistence level of income for the family. If food costs rise, of course, this will be an even more serious problem.

However, PL-480 commodities can be used very effectively to help offset these difficulties. If food is used as part of a school-lunch program, it can be used as an offset to the sacrificed income of participation in schooling and training activities. In effect, students are paid to go to school. In implementing such a program, a very important principle should be kept in mind, namely, the amount of food provided should be sufficient to offset the sacrificed income. In general, this will require more than a school lunch or a school breakfast--it will require that the student be able to take some food home with him. Therefore, the amount of food required for this purpose can be

determined only after local conditions have been taken into account.

Such a policy has a number of important fringe benefits. In the first place, it amounts to using PL-480 and CIP shipments as an investment good--as investment in the human capital of schooling and skills. The social rate of return to such investments is demonstrably high. Moreover, these investments will benefit those at the low end of the income distribution, thereby increasing the income potential of these groups.

Second, inducement of higher participation rates in schooling and training programs will result in some withdrawal from the labor force and a consequent increase in wage rates, especially for the unskilled. This increase in wage rates will further help offset increases in the cost of living that will result from moving to true scarcity prices for consumers.

To conclude this section, it is worth noting that what I have attempted to define is a package of policies that will help move through a transition period that is expected to be quite difficult politically because of the important redistribution of income that is anticipated. Some of the actions suggested may well become permanent features of policy. Obviously prices that reflect true international opportunity costs and true domestic scarcity costs should be a long-term goal of polciy. Some system of taxing agriculture other than through the price system should also be a permanent feature of policy, as should some non-price means of providing income transfers to the poor.

The use of wage subsidies should be a transitional feature of policy, however, and should be supported by well-articulated policy goals and a well-specified time period. The use of PL-480 and CIP commodities should also be a transitional policy. Ultimately, domestic fiscal sources will be needed to replace concessional inputs. The same is true for the school lunch or food-for-school programs. Egypt should

today make a conscious decision to phase out its PL-480 and CIP imports within a reasonable time horizon of say, three to five years. That is the sure route to economic independence and to more rational economic policies.

Finally, the general equilibrium consequences in the wage markets of the above policy mix can be quite substantial. I have attempted to structure the policy mix so that wage increases will be an important means of offsetting income losses from the shift to true scarcity prices. However, this process will require careful monitoring. Those markets that are short on information can experience large changes in response to minor external shocks. Such changes can snowball, with important political consequences. It is therefore important to closely monitor what is going on so as to make mid-course corrections as required.

EGYPT: STRATEGIES FOR ACCELERATING AGRICULTURAL DEVELOPMENT

ANNEX B

EGYPTIAN AGRICULTURAL POLICY: DIAGNOSIS AND AN ADJUSTMENT AGENDA

By

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ANNEX B: AGRICULTURAL POLICY: DIAGNOSIS AND AN ADJUSTMENT AGENDA

I. INTRODUCTION

The elaboration of mechanisms by which resources flow between the agricultural and non-agricultural sectors has been one of the most important contributions of researchers in the field of agricultural development. The trail has been elusive and complex. For example, only in recent years has the full impact on the agricultural sector of macro-economic policies having to do with trade and exchange rate adjustments been understood. These phenomena are complicated in all economies but, because of the extent of governemnt involvement in all phases of economic life, they are particularly difficult to trace in Egypt. Without reasonably functioning markets in a number of the major sectors, it is difficult to ascertain exactly what the incidence of various economic interventions has been. Section I of the following paper is therefore devoted to the topic of explicit and implicit resource transfers and their impact on incentives in agriculture.

Another, more recent contribution made by students of development is the recognition that economic "planning" as it was initially conceived in the 1960's, has been ineffective in most lds's. Although the exercise of preparing a 5-year Plan (and even 25-Year Plans!) was frequently undertaken, the instruments to implement such plans, much less the reasonably determinant environment needed in order to make them succeed, have generally not been present. The failure of long-term planning is not to suggest, of course, that the management of the economy is unimportant. Rather, it has become increasingly evident that the ability to adapt to changing conditions, rather than the effort to implement a blueprint that is outdated before it has been printed, should be the policy maker's goal. The second part of the paper takes such an adaptive perspective in

encouraging the process of change that has been initiated with the Open Door policy and in recommending that this process be accelerated in several key policy areas. The discussion draws heavily on arguments made in a companion paper: "A Scenario for Policy Adjustment," by Edward Schuh which gives particular attention to short-term transition problems.

II. INCENTIVES FOR INCREASING AGRICULTURAL PRODUCTION

A. ECONOMY-WIDE DIMENSIONS OF AGRICULTURAL POLICY

Two aspects of policies vis-a-vis the food and agricultural sector in Egypt are generally recognized. The first is that food consumption in Egypt is highly subsidized, even in rural areas. The second is that farmers receive less than their international opportunity costs (border prices) for a wide range of the products they produce. Correcting these distortions in price relations is generally viewed as a key element in making more efficient use of resources in the agricultural sector and of reducing Egypt's growing dependence on foreign assistance for its food supply.

What appears to be less well recognized is that the discrimination against agriculture and the rural sector is even more severe than the above comparisons suggest. Similarly, the consequences of food being a wage good may be underestimated. Reducing food subsidies will almost inevitably require a rise in nominal wages if significant political unrest is to be avoided. Currently, a significant portion of the wage bill is paid by the public sector by means of implicit food subsidies. Reduction of these subsidies will require a transfer of this portion of the wage bill from the public to the private sector. Hence, any change in food policy has broad implications for the entire economy, with particularly important implications for the profitability of those sectors that use labor intensive technologies. These more general--and possibly more significant--implications of the needed changes in policy vis-a-vis the food and agricultural sector are obtained by taking a broader perspective on agriculture. Within a larger framework, general trade and exchange rate policies become important, as well as the role of food as a wage good and the importance of wage goods in general industrial and development policy.

From an economy-wide perspective, the domestic terms of trade are

an important determinant of the relative profitability of agriculture in the general economy and of the flow of resources between agriculture and the rest of the economy. Simply put, the domestic terms-of-trade can be taken as the ratio of agricultural prices to the prices of industrial products. More generally, one can consider the terms-of-trade to be the price of agricultural products relative to the prices of all other goods and services in the economy.

Two aspects of general economic policy have acted to shift the domestic terms-of-trade more severely against agriculture than the simple comparison of domestic prices with border prices would suggest. The first is the persistent over-valuation of the Egyptian pound in foreign exchange markets. This over-valuation causes world prices to be reflected to the domestic economy at lower levels than they otherwise would be. For crops or products with export potential, this amounts to an implicit export tax, paid for the most part by Egyptian farmers. For products that are imported, the over-valued exchange rate results in what amounts to an import subsidy. In this case, the products imported by means of the import subsidy compete unfairly with domestically produced goods.

Table 1 provides an example of how significant the disparity caused by the over-valuation of the currency can be. If one assumes that the value of the pound in the open market is a reasonable approximation of the equilibrium value of the pound one can see the magnitude of the tax on the products with export potential. For input production, the same disparity would persist.

But the distortion against agriculture is even more severe than these data would suggest. Significant levels of protection are provided to the industrial sector as part of import substituting industrialization policies. Data on the level of effective protection on this sector are not readily available. However, conclusions reached in a recent industrial survey suggest that it is on the order of 20-30 percent more than the estimates in Table 1 suggest. If these figures are even remotely

TABLE 1 PRICE STRUCTURE FOR SELECTED AGRICULTURAL PRODUCTS (1980 IN L.E. PER METRIC TON).

	L.E. Equivalent[1] of International Price at "Market" Exchange Rate	L.E. Equivalent[1] of International Price at Official Exchange Rate (GASA Price)	Farmgate Price	Consumer Price
Rice	320	269	75.00	50.00
Wheat	133	112	76.50	41.20
Sugar	436	366	176.80	100.00
Beans	243	204	161.29	100.00
Lentils	441	370	250.00	110.00
Cotton	959	806	229.50	333.00

[1]Market exchange rate: L.E. .84 = U.S. $1; official exchange rate: L.E. .70 = U.S. $1.

Source: Ag Annex (CDSS Statement). Consumer price for cotton is a USAID estimate of price paid by domestic industrial users.

correct, the domestic terms-of-trade are obviously severely distorted against agriculture.

Unfortunately, people who think about the policy aspects of agriculture tend to be influenced by the parity concept used in regard to U.S. agricultural policies. This concept amounts to comparing an index of prices received by farmers with an index of prices paid. Reasoning from this perspective, they argue that the subsidized prices for imports such as energy and fertilizer can offset the effects of discriminatory prices on the product side. This argument has two deficiencies. First, purchased imports tend to make up a small share of total costs of traditional agriculture. Hence, even if the subsidy on purchased imports is large, seldom do they offset the full effects of distortion on the product price side. Second, parity is implicitly an income comparison concept. It has less to say about the resource allocation effects of price distortions.

The domestic terms-of-trade is the more proper concept to use in examining the sectoral resource allocation question. Two points are important. First, when the terms-of-trade are shifted as severely agains agriculture as they are in Egypt, they grossly alter the relative profitability of the two sectors. Hence, investors considering their investment alternative will tend to choose the non-agricultural sector. Equally important, internal funds generated within agriculture will tend to flow to the more profitable non-farm sector. Considerations such as these are important components of any effort to explain the sluggish growth of Egyptian agriculture in recent years.

The adverse terms-of-trade is also a major factor in explaining the rapid outflow of labor from agriculture. Marginal incentive prices have been shifted away from agriculture and the rural areas and towards the industrial and public sectors in the urban areas. As capital shifts, labor goes with it. This movement has, of course, been exacerbated by the development boom in the Gulf States and Egypt's decision not to restrict foreign outmigration.

Finally, current intersectoral relationships can only be understood in the light of the massive shipments of PL-480 and commodity aid provided by the U.S. foreign assistance program. For example, in fiscal 1981, one-third of the total U.S. aid food shipments ($275 million in PL-480 Title I/III) were committed to Egypt. This amounted to 1.5 million tons of wheat and wheat flour on a grain equivalent basis. (Shipments in 1982 are expected to add another $300 million for a total of $2.5 billion in grain shipments since the resumption of diplomatic relations in 1974) Moreover, in the same year, $158 million of additioanl agricultural commodities (corn, tallow, lentils, etc.) were imported under the Commodity Import Program (CIP). Thus agricultural commodities imported on highly concessional terms in 1981 totaled $433 million or 20 percent of Egypt's total imports.

Unfortunately, there have been only limited efforts to use this food aid for targeted development programs or to move the present policy stance to one that reflects more careful attention to the opportunity cost of the country's domestic resources. The situation is a familiar one in which the resources that would provide the room for policy maneuver are used instead as the means for continuing present practices. It is too strong to say that these commodity shipments caused the government to discriminate against the agricultural sector. But clearly, the availability of food aid on this scale enabled the government to pursue price and income policies that would otherwise have been difficult to maintain. (In the final section and the accompanying "Adjustments" paper, we have tried to suggest how such natural short-run tendencies might be ameliorated in the interests of achieving longer-run economic and social objectives.)

B. RELATIVE PRICES WITHIN AGRICULTURE

A large part of the discussion concerning Egyptian agricultural policy has, quite properly, focused on comparative advantage and the intricacies of the country's farming systems. With a year-round growing

season, numerous crop combinations that compete in various ways for domestic resources are possible. Indeed, it is difficult to follow a discussion of relative price policies without a visual image of a cropping pattern that would be representative of several million acres in the country's agricultural heartland. Figure 1 provides such an overview and is the basis for the following discussion:

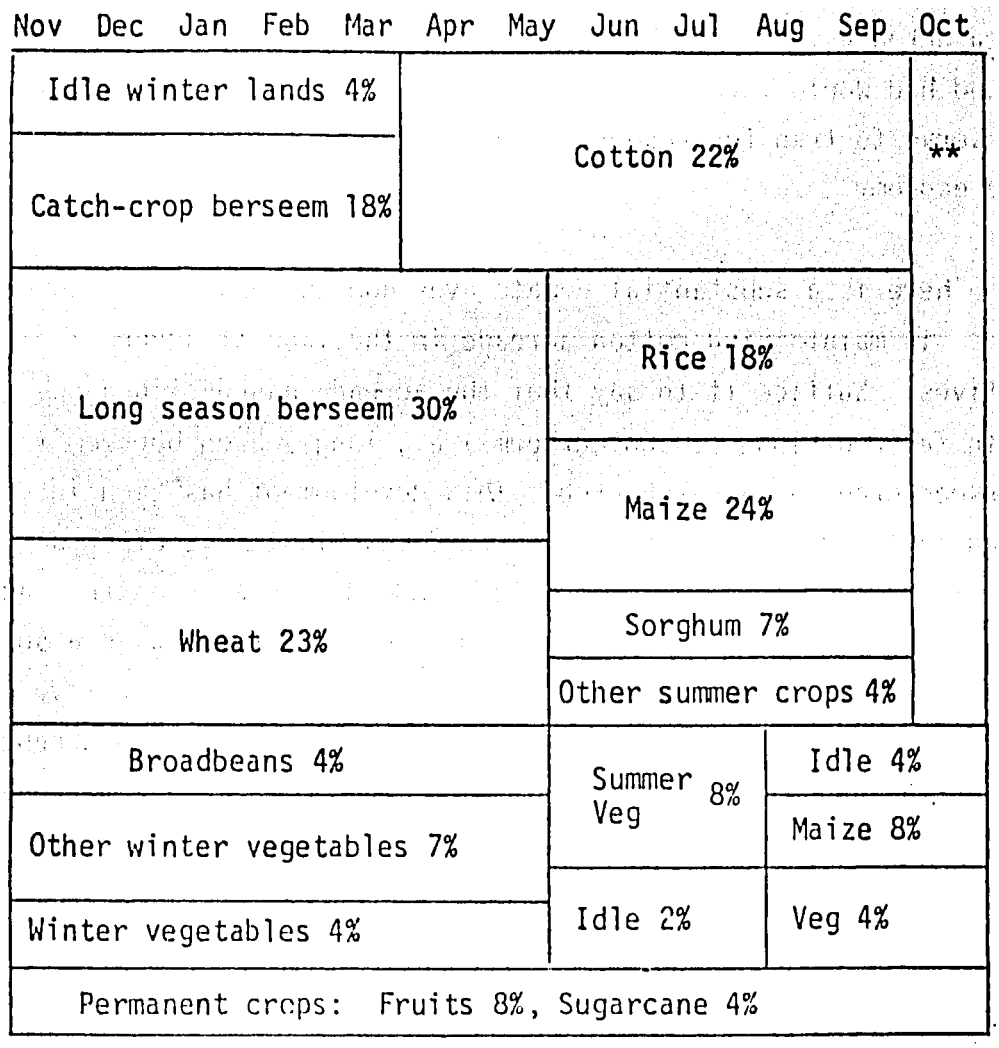
Several key elements that have driven the cropping system in recent years are readily apparent:

1. The competition between wheat, long-season berseem and cotton for land during the February-April period has determined much of the system's behavior. Unlike the arid, irrigated areas of the Indian sub-continent, double cropping with Egypt's extra long staple cotton requires that the land devoted to wheat or berseem be vacated in late winter. This is impossible and the resultant competition for land pits man (wheat) against animals (fodder) against the government (cotton).

2. In certain transitional zones, rice and maize also compete with cotton during the summer season. The advantage to farmers of these crops is their short growing season which permits the maximum area to be put under winter fodder. They are also able to accommodate double cropping with wheat more easily.

3. Short-season vegetables have an important role to play in that they can be fitted in between the major crops such as wheat, cotton, maize and rice. Because of this versatility, the only opportunity cost of land is frequently fallow and consequently even small increases in prices tend to bring forth substantial increases in output.

With the aid of Figure 1, the impact of the current relative output price distortions are easy to see. First, the government's procurement of cotton is being done at prices that make it relatively unprofitable to grow. (See the nominal protection coefficients in Table 1.) Knowing this, the government has also instituted acreage controls that seek to



** Represents lands which are temporarily idle between summer crops, e.g. cotton and rice, and winter crops, e.g. berseem.

Source: Nabil Habashy and James Fitch, "Egypt's Agricultural Cropping Pattern," Micro-Economic Study Unit, Ministry of Agriculture, Arab Republic of Egypt

FIGURE 1. CROPPING PATTERN, 1977-79

minimize the efficiency losses that would otherwise occur. So long as planned acreage is reasonably consistent with what would have been produced had world market relative prices prevailed, such a strategy would serve to transfer resources out of agriculture with a minimum loss to the economy.

There is a substantial debate over how successful the government has been in maintaining cotton acreage in the face of adverse private incentives. Suffice it to say that the acreage has declined substantially in favor of long-season berseem i.e., long-season berseem instead of berseem grown as a catch-crop. This development has been influenced substantially by domestic prices for red meat that have often been 10 to 15 percent above world market levels. Indeed, there is increasing evidence that farmers are combining long-season berseem with a summer green maize crop to provide the year-round fodder that lucrative meat and milk production requires. (This development would also account for the observation heard in the countryside that, while maize prices have declined in the face of the increased availability of wheat for human consumption, maize acreage has remained relatively constant.) The tendency to grow maize in the summer is further reinforced by the fact that farmers must deliver at least part of the competing rice crop at low procurement prices.

The remaining output price of interest is the wheat price. A portion of the wheat crop is procured by the government and, as a consequence, its relative profitability is low when compared to what it might earn if world market prices were to obtain. The impact of this distortion is not altogether straightforward. A glance at Figure 1 shows that wheat competes with livestock fodder for land in the winter and spring. It also competes with cotton. It might appear, therefore, that increases in the cotton price would lead directly to decreases in the acreage under wheat. However, such an analysis would fail to take into account the complementarity between wehat straw and green fodder. Traditionally, straw is mixed with berseem to provide bulk in the ration. When the

demand for straw from poultry and other confined livestock enterprises is added, this practice explains the frequently cited observation that the returns per acre from straw are roughly equal to the returns from procured wheat.

The domestic prices of fruits and vegetables are also uncontrolled and consequently, the incentives to grow these crops in preference to the major staples is easily understood. Figure 1 shows that, while the area under any particular crop is small, the sum total of land devoted to vegetables in both seasons is quite substantial. The inelasticity of demand for perishables is well known, however, and, in the absence of processing facilities, the output of short-season crops is likely to fluctuate considerably.

From the above discussion, it is obvious that the distortion of relative prices between controlled and uncontrolled crops all push the farming system in one direction--livestock. In the winter and spring, low cotton prices coupled with low wheat prices encourage livestock production. In addition, in the summer, low cotton prices and low rice prices combine to encourage the production of the summer fodder that is also a critical input into livestock production. Admittedly, increases in domestic livestock production minimize the need to import meat and dairy products from abroad. Also, because of its labor intensity, the income distribution effects of livestock production on small farms is positive. Nevertheless, the misallocation of resources due to distorted relative prices would appear to be substantial. The pricing of at least some agricultural inputs in Egypt can be seen as part of the country's overall strategy for agricultural development. The disincentive effects of growing cotton, for example, are partially offset by subsidies on fertilizers whose acquisition is contingent upon growing cotton. (Whether the fertilizer actually ends up on cotton or some of the uncontrolled crops is, of course, another matter. The presence of vegetables and fruits, highly responsive to fertilizer, undoubtedly contributes to a substantial diversion of nutrients from their intended destination.)

The subsidy on livestock concentrates does not have the rationale of the fertilizer subsidies. It appears to be aimed at further enhancing the profitability of import substitution in livestock production where considerable effective protection is already being provided by distortions in the crops sector.

From the standpoint of structural change in agriculture, the subsidies on energy and capital have had a detrimental effect on the ability of agriculture to provide increased employment opportunities. Admittedly, there continues to be considerable debate about the forces behind the recent proliferation of tractors and pumps in the countryside. Increased real wages brought about by outmigration to urban areas and to the Gulf States, for example, have surely had some effect on the extent of tractor mechanization. Similarly, the success of the Ford Foundation--Catholic Relief Services sponsored effort to introduce a small axial flow thresher in Egypt can be traced to a combination of increasing wage rates and the sheer physical difficultues of threshing sorghum. On the other hand, in the area of irrigation, the available evidence suggests that the switch from traditional animal and labor intensive methods of lifting water is quite sensitive to energy costs.

Current evidence does not permit a clear-cut diagnosis of future trends in the rural labor market. No one knows if and when the return of laborers from the Gulf States is likely to begin. It is not clear, either, how long the demand for construction labor in Egypt is likely to continue. But given the number of people entering the labor force every year in the rural areas, simple prudence suggests that relative factor prices that favor capital intensive development without substantial increases in productivity should be avoided.

C. PRIVATE INCENTIVES IN AGRICULTURE

Altering relative prices in agriculture could be expected to produce incentives for reallocating resources (land, labor, capital,

etc.) among crops. But it does not follow that such a move would necessarily improve incentives for farmers to invest in augmenting those domestic resources or in searching for improved technology. As the final section of the paper suggests, an important step in policy reform would be to sever the link between relative prices and incomes in order to be able, among other things, to insure that the adequacy of incentives to producer investment was treated more explicitly.

The general supposition in Egyptian policy debates appears to be that it would be desirable to increase the prices of controlled crops, while at the same time keeping the prices of the uncontrolled crops where they are. Such changes would produce a movement of resources in the direction of the agricultural sector and would be justified in terms of the growth process that savings and investment from increased incomes would facilitate.

Much of the experience in developing countries regarding the impact of increased incentives in agriculture has been treated under the heading of aggregate supply response, i.e., the changes in total output that would result from changes in the domestic terms-of-trade. As noted above, there continues to be considerable debate on the strength of this relationship. However, it goes to the heart of any adjustment scenario that involved the redistribution of income between different sectors of the economy and consequently some quantitative assumptions must be made.

There is little evidence from available empirical work that the short-run supply elasticity is much over 0.3. That is, for every 10 percent improvement in the terms-of-trade, the increase in the supply of agricultural commodities would probably be 3 percent or less. This limited response is particularly likely when the land base is restricted, cropping intensities are high, and the increase in supply must come from improvements in yields or a shift in favor of higher valued crops. It is understandable that under these circumstances, policy makers, whose time horizons tend to be largely short-run, are often not terribly

excited by efforts to move the agricultural economy along its aggregate supply curve.

The evidence on the long-run response to improvement in incentives is, fortunately, more positive. The increased responsiveness that has been extensively documented involves, in part, the lagged expectations and perceptions that characterize all adjustment processes. Much more important in the long-run, however, is the possibility that improved incentives will produce outward shifts in the supply curve.

Improving the terms-of-trade to Egyptian agriculture has, as its primary focus, the use of incentives to increase the willingness of farmers to search out and adopt better cultural practices, new varieties, productive durable capital investments, and so on. Such investments in new methods are particularly important when the land base is restricted and a simple expansion of existing technology to additional area is not possible.

The yield increases reported elsewhere in this study suggest that substantial potential for shifting the aggregate supply curve outward does exist in Egypt. For a number of crops, field trials have produced yields that are double the national average. Increases in value-added will, of course, be considerably less because of the need to purchase improved inputs, but there is reason to suppose that the resulting rates of return would reach the 25 to 30 percent that experience suggests is needed if farmers are to change traditional practices. If, in addition, the incentives to search out the improved practices that have been proven experimentally can be stimulated by leaving a somewhat larger portion of the income earned from agriculture in the rural household, then the conditions for a higher growth rate will have been achieved.

D. PUBLIC SECTOR INVESTMENT IN RURAL AREAS

In addition to private investment, substantial investments in the public sector will be required for the sustained development of Egypt's

agriculture. The list of programs and facilities that farmers will generally be unable to provide for themselves is a lengthy one and ranges from physical infrastructure such as roads and marketing facilities to social programs in the fields of education and health. A dynamic agricultural sector, one geared to assimilating a stream of modern technology, needs these facilities and services as much as the more favored urban areas.

Commenting on the priorities that ought to be assigned to public sector investments across the full spectrum of possible programs and projects is clearly beyond the scope of this report. What is disconcerting in the Egyptian case, however, is the dearth of information regarding the potential rates of return to even those alternatives directly related to agricultural production. The project "shelf" of pre-feasibility studies for additional activities in the fields of drainage, irrigation, marketing facilities, roads, rural electrification, and so on, appears to be quite limited. Indeed, with the exception of reclamation, the available evidence suggest the rather drastic conclusion that capital is not a binding constraint to the expansion of public sector investment in the rural areas. (This argument is strengthened by the difficulties that the World Bank has found in extending the unexpired portion of its Sohag and Munufia Mechanization project.) If this diagnosis is correct, a high priority should obviously be accorded to the development of an increased ability to identify projects, conduct feasibility studies and strengthen the monitoring and implementation capacity of the Ministry of Agriculture.

In the absence of concrete alternatives, is there anything general that can be said that would assist in guiding the preparation of additional investment projects?

The returns to investments in physical infrastructure would be highly site-specific. There are undoubtedly a wide variety of possible activities in areas whose settlement histories range from the oldest parts

of the Delta to untouched desert. However, based on the notion that the productivity of additional investment is high when associated with high levels of complementary resources, one would suspect that projects selected according to economic returns would be grouped as follows:

--investments in already farmed areas, primarily old lands
--investments in areas that have been reclaimed but whose productivity can be improved
--reclamation of areas with minimum lift levels and the most promising soils
--reclamation of desert soils

As noted above, within this framework, there are likely to be exceptions to the rule and projects will be found that, after appropriate technical analysis, will have economic merit. Moreover, the government may, for political and social reasons, wish to attach weights to project selection criteria other than economic benefits. For example, there has been considerable discussion of the desirability of large scale reclamation projects on the grounds that additional space is required for an ever increasing population. Investments to expand space, following this line of reasoning, are more desirable than the considerable investments that will be required simply to maintain the productivity and environmental quality of existing agriculture. To the extent that policy makers are willing to trade-off incomes of people currently living on the old lands in favor of adding additional arable lands on which at least some of Egypt's growing population can be settled, the argument of applying weights other than those associated with capital constraints are valid. Indeed, given the low rates of return on reclamation projects identified to date, the whole argument achieves its greatest plausibility when reclamation is linked, not to agriculture, but to settlement. It is not hard to imagine that cities laid out with surrounding green belts would be more attractive to migrants than urban settlements laid out on the barren desert sand.

A second general policy guideline that might be useful in preparing the feasibility studies for additional activities in the rural areas has to do with the tendency in virtually all countries to underinvest in rural people. Numerous studies have shown, for example, that the expenditures on schooling and vocational training in rural areas is usually a fraction of that spent on urban dwellers. The reasons for such discrepancies are numerous, but the effect is to leave the rural labor force with fewer skills and less training than is socially optimal. This deficiency is particularly evident when, in the course of long-term structural transformation, substantial numbers of rural people migrate to the towns and cities. Without adequate skills, migrating labor may often simply place an additioanl demand on urban social services while contributing little to the national social product.

Advocacy of investments in formal schooling is likely to be met with the spector of adding to a rapidly expanding higher education sector, one in which supply has already overrun demand. Secondary education is also suspect since, in some measure, it leads to additional demands for the university education that is the desired passport to employment in the public sector. However, the top-heavy educational pyramid which has frequently been castigated in the Egyptian press should not be allowed to obscure the importance of primary education and the achievement of literacy. Moreover, in addition to a continued investment in formal schooling at the primary level, substantial investments in vocational training would be highly desirable. Initially, this might be seen as a drain on the country's resources in that many of those trained in mechanical and construction skills would migrate to the Gulf States. However, as noted elsewhere in this report, the practice of sending home remittances distinguishes rural migration in Egypt from the rural-urban movements found in more developed countries. Since most migrants do not intend to remain outside Egypt for long periods of time, their return also brings an increment of human capital in the form of increased knowledge and skills gained from working abroad.

E. PLANNING FOR STRUCTURAL CHANGE

The effects of short-run agricultural price policies and investment decisions will, if pursued for significant periods of time, have a substantial impact on the structural transformation of both the sector and the wider economy. Subsidies on capital and fuel that promote mechanization will affect the size of the labor force. Investments in rural education will also have an effect on the agricultural labor force by facilitating migration to the urban areas. However, there are several types of policies and programs that are more directly linked to long-term efforts to shape the characteristics of the agricultural sector. Of these, two are mentioned below: (1) decisions about land tenure and the land market, and (2) the decentralization of economic activity through the planned dispersion of industrial investments.

1. Farm Size and Farm Incomes: The period since 1973 has seen an unusual rise in wage rates in agriculture. During The 1973-1978 period, real wages increased at an annual rate of 12-14 percent. Something approximating this rate of change appears to have carried over to the present time since nominal wages increased some 30 percent in 1980 compared to 1979--substantially above the rate of inflation.

Despite this rapid increase in real wages in agriculture in recent years, *per capita* incomes in agriculture are still substantially below those in the non-farm sector. There apparently are no careful estimates of this income disparity. However, most general estimates suggest that *per capita* incomes are something less than half those in the non-farm sector. Certainly, the size of the rural-urban flow of resources suggests that the differential is significant.

If *per capita* incomes continue to rise in the Egyptian economy as a whole, policy-makers wil eventually have to face the farm enlargement issue and problems associated with the present tenure code.

Farm enlargement is not basically, as is so often thought, a technological issue. Instead, in every country that has gone through a significant structural change in the rural areas, it is clear that a substantial part of the enlargement process has been driven by increases in per capita incomes. Larger farm sizes are needed to provide incomes comparable to those in the non-farm sector. Workers leave the agricultural sector because their land holdings do not enable them to earn an income comparable to their city neighbors. When they leave the land is recombined with that of other farms into larger units. (The presence of cost-reducing, labor-saving, indivisible mechanical technology obviously does play a role in that decision.)

Farm size may not be a problem now in the aggregate, nor may it be a problem in the near future. However, there are two efficiency issues surrounding current tenure relationships toward which policy makers need to develop additional sensitivity. The first of these has to do with the continuing fragmentation of land holdings. Given that the forces of economic development will eventually require enlargement of operating units, it might be well to look once again at the consolidation problem. Past experience with programs of this sort has not been terribly encouraging, but the economic environment may be changing sufficiently to warrant at least an exploration of the disirability of developing a program that would facilitate the recombination of scattered holdings.

A more thorny issue in the field of land tenure is the need to sever the rigid connection between the land tax and cash rents. Rent payments play an important role in the allocation of land in agriculture. The free play of market forces is required if land is to be allocated to its highest value uses. Consequently, from an efficiency point of view, the restrictions placed on land taxes not only inhibit the emergence of a land market, but make it difficult to develop a lump-sum system of agricultural taxation as well.

While the arguments from economic efficiency are obvious, equally obvious are the social implications of altering the land tenure system. Egypt is one of the few developing countries where, after an agrarian reform, tenants have been able to exert sufficient pressures to maintain a reasonable degree of control over the rights that were assigned to them immediately after the Revolution. Removing these rights by freeing up the land market and permitting supply and demand to determine the rental rates would obviously erode the tenants position vis-a-vis the landlord. Considerable study would be required before such an outcome could be unequivocally advocated. Nevertheless, it is merely a matter of time before the land tenure issue must be placed on the national agenda. The intervening period could profitably be used to undertake in-depth research on the issue.

2. Decentralization of Economic Activity: A second long-term policy that would play a significant role in determining the characteristics of the agricultural sector has to do with incentives and programs to disperse industrial and service activities away from Cairo and Alexandria. As the Japanese experience shows, the provision of job opportunities in rural areas will enable rural families to raise their incomes without necessarily having to migrate to urban centers. Becoming a nation of part-time farmers would, in the long run, take some of the pressure off the land to produce incomes that were comparable to those obtained in the cities. Moreover, slowing the migration of large numbers of labor to urban centers would minimize costly externalities in both the exporting and importing regions. Developing social infrastructure in some of the lesser residential centers would also reduce the large commuting costs that are now incurred as people of all social classes seek to maintain residence in the central cities while actually working at Provincial-level jobs.

III. AN AGENDA FOR ADJUSTMENT

The previous section has been largely diagnostic in character. It leads, however, to three propositions that are at the core of the team's recommendations regarding the policy adjustments needed to make Egyptian agriculture more productive. When coupled with suggestions as to how the substantive recommendations might be made operational, the propositions constitute the basis for a policy adjustment strategy that would, for the most part, be played out in the agricultural sector. (See the companion piece "A Scenario for Policy Adjustments" for a fuller discussion of the economy-wide implications of the adjustments being proposed.) The propositions that underlie the suggested adjustments are the following:

1. In order for the technological potential discussed in Chapter 2 (Main Report) to be realized, there will need to be some realignment of agricultural prices. While there appears to be considerable scope for increasing yields in many of the major crops, Egypt is not on the brink of a "green revolution." Unlike India and Pakistan in the late 1960's when the package of increased water supplies, improved seeds and fertilizers were sufficiently productive to create their own investment incentives, Egypt will have to be content with more modest gain. Nevertheless, the maturity of its agriculture and the knowledgeability of its farmers bode well for a sustained, long-term increase in productivity provided appropriate incentives exist. However, improvements in the overall domestic terms of trade will be necessary if private investment is to bear the burden that this adjustment strategy puts upon it.

2. The shifts in relative prices and in the terms of trade between agriculture and non-agriculture will require some compensatory actions in order to minimize the hardships on those who cannot escape the distributive consequence of the adjustment policies. A basic argument of the previous section has been that, as a result of improvements in productivity, long-term growth will provide an increase in output that will make everyone better off. In the short run, however, there will clearly be

gainers and losers. Political reality dictates that those losing should be helped to adjust to a new and less favorable economic environment. (By symmetric reasoning, those receiving windfall gains should have it taxed away.)

3. A third proposition on which the adjustment strategy is based is prompted by the inhibitions to change that come from uncertainties about the precise effects that changes in the relative prices of agricultural commodities and the removal of production subsidies will have on the sector and the economy. One of the legacies of a highly distorted economy is that it is extremely hard to trace the incidence of taxes and subsidies through to the household or production unit. However, rather than wait until a comprehensive bluepring in established, the approach to change should, in our view, have a strong adaptive flavor. There is little dispute about the direction that the initial steps should take; what is important is to create a mechanism for assessing the impact of each adjustment before undertaking the next step. The design of a systematic approach to gathering information on the adjustment process is necessary, not only from a substantive point of view, but as a means of protecting and informing policy makers who will be innundated with advice about the effects of changes from the gainers and losers referred to earlier. If no preparation is made for an adequate monitoring system, it will be difficult for administrators to hold a steady course until their ultimate goal has been achieved.

The general strategy then, is (1) to begin to move agricultural prices toward a set of relative prices that will provide correct signals for the efficient allocation of resources, (2) to provide a series of compensatory measures that will minimize the difficulties various groups might have in adjusting to the distributive consequences of the relative price changes, and (3) as a part of the process, to set up an information processing system for monitoring the impact of the adjustment process on various segments of the economy.

A. ADJUSTING OUTPUT PRICES

From a tactical or commodity-specific point of view, the best place to begin would be with producer prices. The policy dialogue in Egypt has dwelt most frequently on this matter and it is likely to encounter the least resistance. Among producer prices, the clear candidate for initial price rationalization is the price of cotton. Even though the technological potential may not be as impressive as reported in some of the other crops, it is a key element in diminishing the government's intervention in the agricultural sector.

A critical question with respect to cotton--and rice--is whether, in the initial phases of the adjustment process, acreage controls should also be removed. This depends in large measure on how big the steps in price increases will be. The ultimate goal would be to permit prices to play the dominant role in determining resource allocations. But this would mean that very large steps would be required to attain some semblance on appropriate relative prices in the short run. Assuming that increments to prices would be more gradual, the absence of market-generated knowledge about comparative advantage suggests that it would be prudent to maintain acreage controls for at least the first year or two. However, as cotton prices began to approach prices prevailing in world markets, the government could remove the various components of the acreage and procurement system which would then be redundant. (It is well to note at this point that efforts to get farmers to plant contiguous acreages of cotton for the purpose of pest control is not contingent upon acreage requirements!)

Improving the cotton price would have a positive effect in countering the allocation of acreage to berseem grown in the winter for livestock, thereby dampening the effects of uncontrolled livestock prices. Similarly, in the cotton growing areas, it would also raise the opportunity cost of summer maize which would further act to discourage the inefficient use of land for livestock fodder.

Changing the cotton price would also, of course, have short and long term distributive effects that need to be considered. In the short run, for example, it could be expected to have a negative impact on government revenues. How much again depends upon the farmer's supply response. It would also raise the price of raw materials to the textile industry which, in turn, would raise the price of domestic cloth and make any exports to foreign markets less competitive.

With respect to government revenues, it is to be hoped that the diminished role that agriculture now plays in foreign exchange earnings would make it possible for the losses to be absorbed by the earnings of the Big Four: oil, tourism, remittances and the Suez Canal. A decade ago, such a scenario would have been inconceivable; however, both the size and the composition of the Egyptian economy have changed dramatically since 1975 and it would appear that the costs to the Treasury of moving to a more efficient allocation of land resources could be absorbed within the framework of other, more primary sources of foreign exchange earnings.

In the long run, pricing cotton at its opportunity cost to the textile industry should be a goal of government industrial policy. In the short run, however, it would be desirable to give the industry time to make the necessary adjustments to a more competitive market situation. For example, during a period of, say, three years, it might be advisable to provide a limited subsidy on the raw materials used by the textile sub-sector. (The possibility of using the flexibility of the Commodity Import Program to assist in this transition period should obviously be explored.)

A second step in the liberalization of agricultural prices would be to cease the compulsary procurement of rice. With decontrolled cotton prices, such a step would not generate an undesirable expansion of rice acreage in the transition zone between the two areas. Moreover, increasing the rice price would further dampen the effects of uncontrolled

livestock prices by providing another alternative to summer fodder. Lastly, because of the technology package that has been identified for rice, it would be a particularly good candidate for increased investment incentives.

The third, and probably thorniest step, would be to develop a more appropriate approach to maintaining producer incentives to grow wheat. The appropriate pricing of wheat is, of course, complicated by the large resource transfers that are made possible through PL-480 shipments. The 1.5 million tons imported by the government in 1981 under highly concessional terms has made it possible to establish an issue price for wheat and flour that is substantially below the world marker price. The immediate impact of subsidized wheat is to create false signals to producers both in allocating land to wheat and in applying high levels of purchased inputs. Because of the desirability of maintaining a low wheat to straw ratio, it has even inhibited the use of dwarf high yielding varieties. Admittedly, in the longer run, the availability of cheap food grain has permitted the country to maintain a high level of consumption. However, by providing inexpensive food to a large share of the population, it has also created expectations and life styles that can only be maintained by a substantial dependence on foreign imports. The failure to target PL-480 on disadvantaged groups or on in-kind payments designed to generate capital investments, has added to the problem.

It would be naive to call for an elimination of PL-480 imports simply on the grounds that they create disincentives to agriculture. There is little doubt in the minds of Egyptian planners that PL-480 dollars are not hard currency dollars and they are probably correct. This being the case, is there anything that might be done that would offset some of the disincentive effects of concessional imports on domestic wheat producers?

Aside from various targeting measures dealt with in greater detail in the "Adjustments" paper, it would seem useful to explore the possibility

of pursuing a more positive domestic procurement policy. The logic of commercial purchases to round out needed wheat imports appears to rest on the belief that it would be less costly to purchase grain internationally than to attempt to increase the supply of domestically produced wheat by raising local prices. The correctness of this perception is again dependent upon the anticipated supply response. However, the technological potential for wheat is extremely promising and would seem to merit efforts to overcome the major stumbling block, namely, the establishment of an effective procurement and storage system. If there is any operational content at all in the repeatedly expressed concern for food security, it lies to a considerable extent in developing a more effective two-tier pricing system for wheat.

B. ADJUSTING INPUT PRICES

The intersectoral distributive consequences of changing relative agricultural prices are likely to be important. Consequently, they cannot be recommended without giving some consideration to the compensatory policies that might be desirable to lessen the impact of the needed efficiency adjustments. Certain measures within the agricultural sector are obvious. For example, with increased revenues in the agricultural sector, the subsidies for inputs such as fertilizer, feed concentrates, pesticides, energy, etc., should be reexamined.

The most obvious prices to adjust would be those of fertilizers and pesticides. Neither need be abolished overnight, but the rationale for both is diminished by the proposed increase in product prices.

The subsidy on concentrates has very little rationale since livestock prices are currently uncontrolled. If there is a positive argument for controls, it is that cottonseed cake has been procured at much less than its world market value and the subsidy is a means of giving the tax back to farmers in an alternative form. Unfortunately, the fact that the farmers who grow cotton are not necessarily the ones who benefit

from cheap concentrates casts doubt on the logic of the argument.

In the long run, of course, the pricing of inputs such as energy and water are also crucial to rationalizing the relationship of agriculture to the rest of the economy. Currently, these subsidies are encouraging the use of inputs in ways which are detrimental to both the economic and environmental health of the agricultural sector. There would be no need to continue to pursue subsidies that build in long-term structural disincentives if output prices reflected world market relatives. Appropriate methods of lump-sum taxation could extract the revenues needed for the maintenance of the irrigation and drainage system and the provision of rural infrastructure without generating inappropriate signals for resource allocation or producer disincentives.

C. SUMMARY

In summary, the approach to policy rationalization recommended by the team would proceed as follows:

1. Raise the prices of cotton and rice, both to improve producer incentives and to off-set uncontrolled livestock prices.
2. Explore ways to improve the domestic procurement system for wheat so as to create additional producer incentives for adopting the technology package that appears to be available.
3. Remove input subsidies as rapidly as possible beginning with fertilizer, pesticides and feed concentrates.
4. Set up a high-level cell in the Ministry of Agriculture charged with monitoring the policy adjustment process. (This could be an explicit charge to the Agricultural Data Collection and Analysis project.)
5. Begin to explore alternative forms of lump-sum taxation that would permit agriculture to pay for its share of infrastructural investments without the disincentives associated with using the price system for income transfers.

6. Accelerate the preparation of a plausible project shelf for public sector investments in the fields of irrigation, drainage, market facilities, roads, etc.

APPENDIX A

INTERSECTORAL SUBSIDY FLOWS

Three components of economic activity in Egypt are shown in Figure 1A: the agricultural sector which produces food and fiber, all other sectors of the economy that produce goods and services ("rest of the economy") and consumers of food and fiber. The figure shows the net flow of subsidies relating to the production and consumption of agricultural commodities among the three components.

In 1975, the agricultural sector subsidized the Egyptian consumer by L.E. 0.6 billion. This is the value of revenue lost to producers by providing food and fiber produced domestically at farm prices below their world market price equivalents. Agriculture also provided a 0.6 billion net subsidy to the "rest of the economy." This represents implicit tax revenues (agricultural commodities exported at world prices but obtained from the farmer at substantially lower prices) minus subsidies provided farmers on inputs such as water, energy, fertilizer, seeds and pesticides. (Note: it does not account for a wide range of consumer goods sold to agriculture at above world market prices. See distinction between parity prices and terms of trade in the Section I.) This flow represents agriculture's contribution to the rest of the economy, narrowly defined. Finally, the "rest of the economy" provided a subsidy to consumers of L.E. 0.4 billion representing the loss of the sale of food and fiber production to consumers at less than their import price or less than the Egyptian farm purchase price.

According to Figure 1A:

1. Consumption of food and fiber was heavily subsidized in 1975 and the subsidy was even larger in 1980.

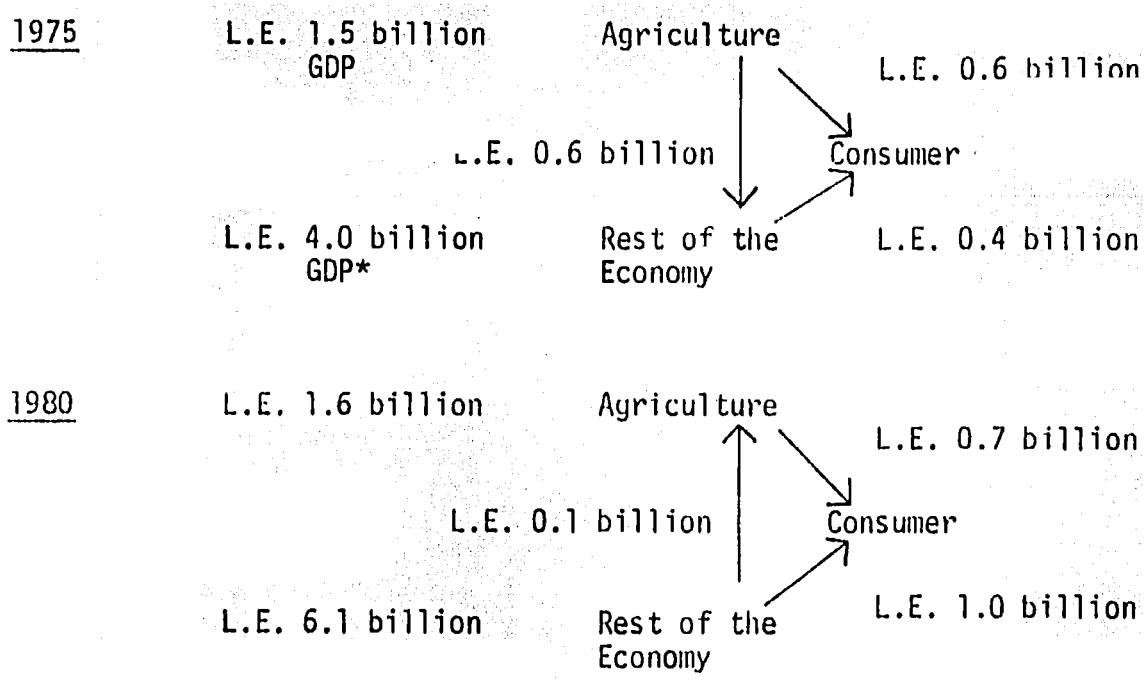
2. Agriculture provided 60 percent of the consumer subsidy in 1975

and 40 percent in 1980 even though agriculture represented only 27 percent of the gross domestic product in 1975 and 21 percent in 1980.

3. When measured in terms of outputs and production inputs, agriculture's contribution to the growth of the rest of the economy was significant in 1975 but negative by 1980.

4. Healthy growth occurred in the rest of the economy beween 1975 and 1980--9 percent per year in GDP.

5. Stagnation occurred in the agricultural sector--1.3 percent growth in GDP during the 1975-1980 period.



* Gross domestic product in 1975 prices.

FIGURE 1A: NET FLOW OF FOOD AND FIBER PRODUCTION AND CONSUMPTION SUBSIDIES, EGYPT, 1975 AND 1980.

Source: 1975, Cuddihy
1980, Frankel

EGYPT: STRATEGIES FOR ACCELERATING AGRICULTURAL DEVELOPMENT

ANNEX C

ORGANIZATIONS AND INSTITUTIONS

By

Omer Kelley, Regional Director Soil and Water Research, USDA, USAID, and Office of Technology Assessment, U.S. Congress, and

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ANNEX C: ORGANIZATION AND INSTITUTIONS

I. PRESENT SITUATION - MINISTRIES INVOLVED AND THEIR RESPONSIBILITIES

A. OVERVIEW

The four ministries directly involved in activities related to differrent aspects of the agricultural sector are the Ministry of Agriculture, the Ministry of Irrigation (MOI), the Ministry of Reconstruction and Land Reclamation (MLR), and the Ministry of Supply. Each Ministry generally acts very much in its own right, with minimum coordination. In addition to the Division and Directorates within these ministries, the system of administration relies on several public organizations and/or companies whose number has increased considerably with the expansion of the Government (public sector) in various fields. While this set-up has been dictated by the need for decentralization, it has also created problems of control and coordination.

A number of other ministries are also concerned with general or specific functions bearing on agriculture. These include the Ministries of Planning, Economy, Industry, Transportation and Treasury.

The Ministry of Planning must approve all new projects, the budgets of all ongoing projects and to a certain extent project content.

The Ministry of Economy has jurisdiction over export marketing and mobilizes international financing for various projects.

Both the Ministries of Finance and Supply are concerned with prices paid to farmers for their products. More recently, greater powers are being given at the Governorate level for planning and execution of projects in the agricultural sector.

The Ministry of Industry is concerned primarily with processing of agricultural commodities. This Ministry builds its own plants, purchases

agricultural commodities from local dealers and processes the products. These products go to the Ministry of Supply for distribution. There are some private processors. They can sell their products on the local market and their prices are not controlled. They may range from three to five times more than the government subsidized price.

While all of these ministries interact with the agricultural sector, it is the Ministries of Agriculture, Irrigation, Reconstruction and Land Reclamation, and Supply that are the prime ministries in developing an integrated agricultural strategy for Egypt. Therefore, it is useful to take a closer look at the organization and responsibilities of these agricultural-related ministries.

B. THE MINISTRY OF AGRICULTURE AND FOOD SECURITY (MOA) AND RELATED RESEARCH INSTITUTIONS

The Ministry initiates and implements most of the policies relating to the agricultural sector. It oversees farm production, and heavily influences farm output through crop quotas, fixed crop rotations, and inputs. Other responsibilities include technical and economic research, introduction and implementation of new technologies, extension work, and commodity export activities.

The Ministry is composed of 13 line ministries (undersecretariats) and is also associated with many autonomous and semi-autonomous general organizations (Figure 1). The structure of this system is nonsymmetric and complex. In many cases, functions and activities of the undersecretariats overlap those of other undersecretariats and/or general organizations. Authority is diffused, and efficiency suffers.

Undersecretariats

The 14 undersecretariats are the major departments or line ministries within the Ministry of Agriculture. These are: Agricultural Cooperatives, Agricultural Extension, Agricultural Economics, Agricultural Engineering, Horticulture, Animal Production, Pest Control,

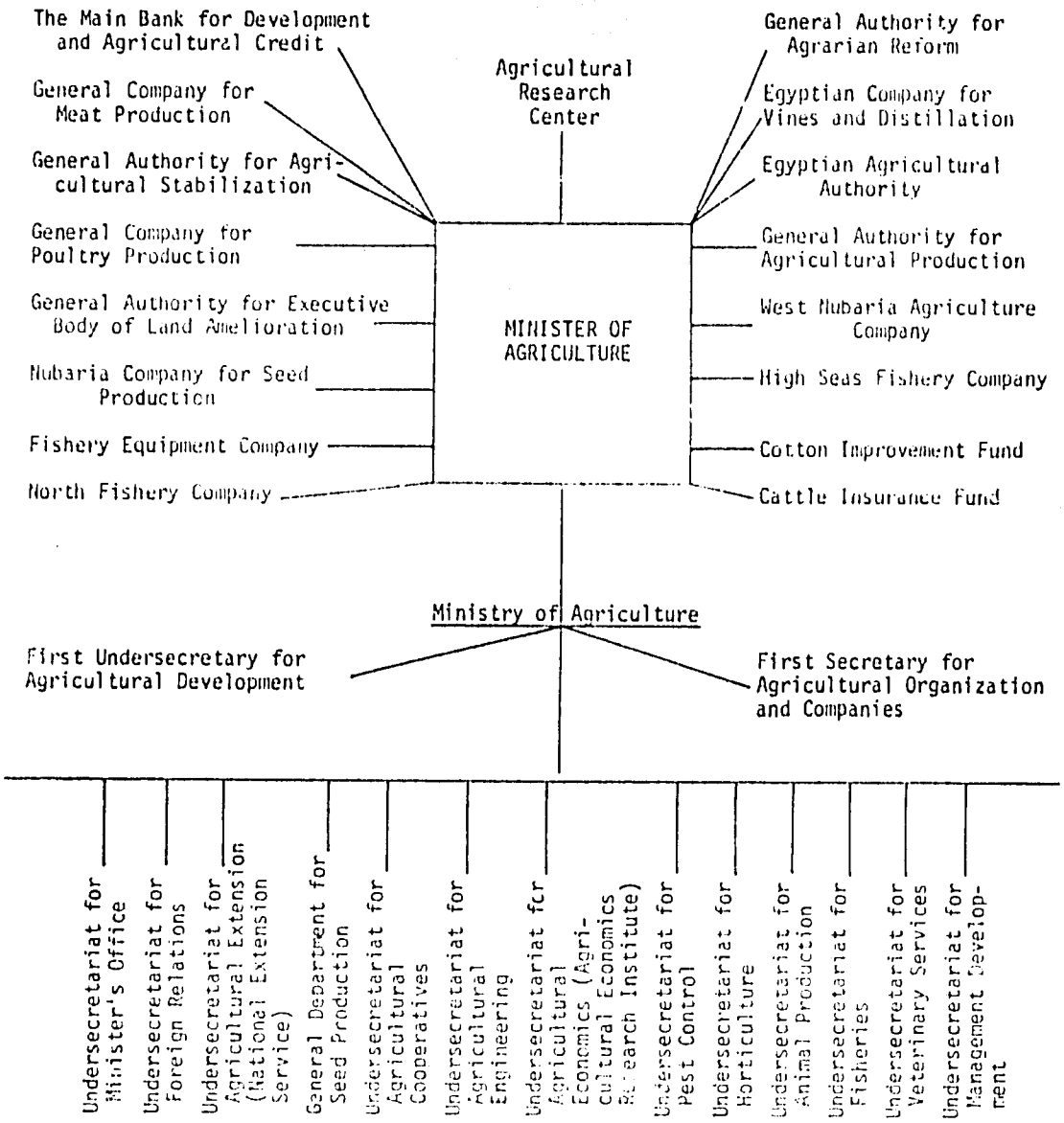

FIGURE 1 EGYPT: MINISTRY OF AGRICULTURE, AND ITS ORGANIZATIONS AND COMPANIES.

Source: Ministry of Agriculture.

Veterinary Services, Fisheries, Seed Production, Foreign Relations, Management Development, Minister's Office, and the General Secretariat.

An important undersecretariat for purposes of the present study is that for Agricultural Cooperatives, which oversees the Deaprtment of Agrarian Reform, and the Department for Land Reclamation.

The agricultural cooperative system existed prior to 1952, but was strengthened afterwards since all recipients of redistributed land became compulsory members. The cooperatives oversee plantings, crop rotations, and input distribution among the small farms, especially for mandated crops. Often the cooperatives were the only suppliers of feed, fertilizers and insecticides. At the local level the cooperatives work closely and often intermixed with the Principal Bank for Development and Agricultural Credit. The cooperatives become government institutions for paying low fixed prices for farm output. The cooperatives occasionally taxed inputs. Today most inputs are sold through the cooperatives at heavily subsidized prices.

Agricultural Extension is another important undersecretariat which oversees the National Extension Service (NES). The NES has six departments: Crop Development, Animal Production, Rural Development, Extension Methods, Mechanization and Joint Projects, and Programming. The central staff of these departments is based in Cairo. Staff in the governorates and villages fall under the following administrative hierarchy: governorate extension director, governorate extension inspectors (1 per 2 districts), district extension directors (1 per district), regional supervisor, village extension workers. Village extension workers make up about 70 percent of the entire NES staff. They currently comprise 2,300 of 3,310 employees.[1/]

[1/] AID, "Recommendations for a Strengthened Agricultural Extension Program in Egypt" (BIFAD), November 1981 pp. 20-21.

Most of Egypt's 123 districts (markazes) have a staff extension office, plus a demonstration farm of about 10 feddans. These farms use new varieties, improved pesticides, appropriate fertilizers, and improved cultivation techniques.

General Organizations

The organizations are not fiscally responsible to the Ministry and have separate budgets. Nor are they subject to the same personnel regulations and other policies. In the overall budget planning process, they compete for funds with the Ministry, but the Minister is the "Chairman of the Board" of these organizations. The general organizations have both commodity specific, and technical managerial functions.

The commodity specific authorities are the General Company for Poultry Production, the General Company for Meat Production, the Egyptian Company for Vines and Distillation, the High Seas Fishery Company, the Nubaria Company for Seed Production, the West Nubaria Agricultural Company, the North Fishery Company, the Cotton Improvement Fund and the Cattle Insurance Fund.

The organizations committed to agricultural management or assistance are the Principal Bank for Development and Agricultural Credit, the Agricultural Research Center, the General Authority for Agricultural Stabilization, the General Authority for Executive Body of Land Amelioration, the Egyptian Agricultural Authority, and the General Authority for Agricultural Production.

The commodity specific organizations are for the most part the offshoot of private production companies that were nationalized in the 1960's. The following is a short description of the functions of the semi-autonomous organizations, except ARC which is discussed on pages 8-12.

1. North Fishing Company--fishes in the Mediterranean area, sells fish to the Ministry of Supply.

2. High Seas Fishing Company--same except fishes on high seas.

3. Fishery Equipment Company--purchases and provides all fishing.

4. Nubaria Company for Seed Production--located on newly reclaimed land (desert); propagates or increases foundation and other seeds, primarily horticultural (vegetable crops).

5. General Authority for Executive Body of Land Amelioration--might be considered an operation arm of the Soil and Water Research Institute of ARC for routine soil analyses, Gypsum, subsoiling, drainage, etc. They decide what the farms need. They do it, and charge for it.

6. General Authority for Agricultural Stabilization--provides subsidies for fertilizers, pesticides, etc. (especially for cotton, soybeans). If subsidies were dropped this agency could be abandoned or become a private company.

7. General Company for Meat Production--produces meat and milk but also provides improved breeds. They have several farms, purchase calves and fatten them, and sell to the Ministry of Supply.

8. General Company for Poultry Production--provides basic needs for broiler firms (1 day old chicks, feed, etc.). Also sell to small growers when there is a demand. They also produce their own broilers and sell to the Ministry of Supply. Broiler companies and farmers can sell on the open market.

9. The Main Bank for Development and Agricultural Credit--has branches in every district and in some villages. Each Governorate has an autonomous bank with its own board of directors. Every district has a bank and storage facility for all farmer inputs. These are basically farm supply stores. They work closely with the cooperatives and cooperative members purchase at a lower price than a nonmember. Credit is six percent/year. Provides credit.

10. General Authority for Agricultural Reform--works on lands that were subdivided as a result of the land reform laws. They have their own cooperatives, plan cropping systems, assist farmers in production, provide marketing channels etc.

11. Egyptian Company for Vines and Distillation--produces grapes for table and wine, does its own processing and marketing.

12. Egyptian Agricultural Authority--has an experimental farm, imports seeds (especially vegetables) for farmers, and also imports and sells fertilizers, but at a 50-percnet subsidy compared to 100 percent by the cooperatives through the Agricultural Credit Bank. This gives the farmer an opportunity to purchase more fertilizer than allocated by the bank and/or cooperative.

13. General Authority for Agricultural Production--operates land owned by MOA for increasing foundation and other seeds and operates land for experiment stations, sometimes stresses seed production at the expense of research (should be under ARC).

14. West Nubaria Agricultural Company--also on newly reclaimed land, but just an agricultural production company that can sell on local market.

15. Cotton Improvement Fund--basically a collection agency to provide additional funds for cotton research in cooperation with ARC.

16. Cattle Insurance Fund--insures life of cattle. Insurance is supposed to be optional, but in reality it is not. Farmers must insure to borrow money for cattle, feed etc. (credit). The fund makes money.

An example of the complexities surrounding these organizations is the General Company for Poultry Production, which produces about 25 percent of Egypt's domestic poultry supply. Although attached to the Ministry of Agriculture, the CGPP receives its budget requirements from the Ministry of Finance. It receives its commodity import requirements,

including feed, from the Ministry of Supply. The CGPP operates large broiler production firms.

Among the autonomous organizations related to agricultural management and assistance, one of the more important is the Principal Bank for Development and Agricultural Credit, which provides most of the credit in the farm system and has district and village stores for farm inputs. The Bank subsidizes farmer credit, and operates at a loss.[1] The Bank has a representative accountant at each village cooperative.

The Agricultural Research Center

The Agricultural Research Center is the research arm of the Ministry of Agriculture. It is an autonomous organization not subject to many of the bureaucratic rules of the traditional ministry. The Minister of Agriculture serves as Chairman of the Board, but the Deputy Chairman serves as the day-to-day operational head. The latter has two deputies, one who is responsible for general services and administration and the other for the research institutes. There is a Board of Directorate between the Chairman (Minister) and the Deputy Chairman. There are 14 Research Institutes within the Agricultural Research Center. They are as follows:

1. Cotton Production Research Institute
2. Soils and Water Research Institute
3. Field Crops Research Institute
4. Horticulture Research Institute
5. Plant Pathology Research Institute
6. Agricultural Mechanization Research Institute
7. Veterinary Research Institute
8. Animal Production Research Institute
9. Plant Protection Research Institute
10. Desert Institute

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[1] W. Cuddahy, Agricultural Price Management in Egypt, World Bank Paper, p. 72.

11. Extension Research Institute
12. Agriculture Economics Research Institute
13. Egyptian Flora Research Institute
14. Sugar Research Institute

The Center has the overall administrative responsibilities for the 14 institutes including personnel policies, budgets and program coordination. The Research Institutes are all located within the Cairo area.

There are 31 research stations located throughout Egypt that are organized into the following three categories:

1. Animal Production Stations (12)

El-Serw	(Domiatt Province)
Montazah	(Alexandria Province)
Borg-El-Arab	(Matrouh Province)
Sakha	(Kafr El-Sheikh Province)
Mahalet Mousa	(Kafr El-Sheikh Province)
El Gammieza	(Gharbia Province)
Geziret El-Shaier	(Qalubiya Province)
Anshass	(Sharqia Province)
Douki	(Giza Province)
El-Fayoum	(Fayoum Province)
Sids	(Beni-Suef Province)
Mallawy	(Minia Province)

2. Horticulture Stations (6)

El-Sabahia	(Alexandria Province)
El-Nubaria	(Tahrir Province)
El-Tahrir	(Tahrir Province)
El-Qanater	(Qalubia Province)
El-Ismailya	(Ismailya Province)
Sids	(Beni-Suef Province)

3. Agricultural Research Stations (13)

Sakha	(Kafr El-Sheikh Province)
Gemmeiza	(Gharbiya Province)
El-Serw	(Tahrir Province)
Nubariya	(Tahrir Province)
Sers El-Layan	(Menofia Province)
Bahteem	(Qalubiya Province)
El-Ismailya	(Ismailya Province)
Sids	(Beni-Suef Province)
Mallawy	(Minia Province)
Shandawil	(Suhag Province)
El-Mataana	(Qina Province)
Kom-Ombo	(Aswan Province)
Giza	(Giza Province)

The latter category includes all of the field crops, plus the disciplines associated with them.

The land on which the research stations are located is owned and operated by the General Authority for Agricultural Production. The latter does the actual farming for the research program including land assignments, land preparation, cultivation and harvesting, except where donor projects are concerned. The Center pays for this service.

The Agricultural Research Center has 19,000 employees including 685 with Ph.D. degrees. Within the 14 Institutes the professional credentials of personnel are as follows:

	Ph.D.	M.Sc.
Cotton Institute	45	79
Field Crop Institute	73	141
Sugar Institute	7	8
Horticulture Institute	73	93
Soils Institute	91	114

Plant Protection Institute	116	251
Plant Pathology Institute	63	112
Animal Production Institue	47	101
Animal Health Institute	79	149
Desert Institute	73	64
Agricultural Economics Institute	14	73
Extension Insitute	3	20
Agricultural Mechanization Institute	-	1
Flora Insitute	1	0

Most of those with a M.Sc. Degree are working toward the Ph.D. Degree because only those with such a degree can be appointed to the Professor's rank (ARC staff have professional titles). There is also a career ladder for those not pursuing advanced training but obviously salary ceilings are lower.

Salaries are presumably commensurate with university professors but still low. The beginning salary of someone with a Ph.D. is 91 L.E. per month. Even so, employees of the Research Center are better paid than those within the Ministry. Those pursuing graduate degrees are permitted the equivalent of two days per week to attend classes.

The ARC budget for 1981-1982 is as follows:

Salaries	LE 9,816,498
Incentives	854,562
Fringe Benefits	562,153
Other Allowances	1,416,787
Total	12,650,000
Operations	
Materials	LE 1,616,000
Services	1,059,000
Running Transfers	14,000
Specific Running Transfers	40,000
Investments	4,650,000
Total	7,650,000
GRAND TOTAL	LE 20,029,000

These amounts are Egyptian funds and do not include PL-480 grants or AID sponsored projects--or other out-of-country donor funds. Of the 11,547,279 LE of PL-480[1] funds expended in Egypt for the agricultural sector in 1961-1979, 57 percent or 6,587,883 LE was spent for research within the Research Institutes of the Agricultural Research Center.

In addition to the Agricultural Research Center, the Academy of Scientific Research and Technology and universitites with agricultural faculties have roles in agricultural research and training, all necessary for accelerating agricultural development. Since these functions are so closely related, they are discussed here even though the universities are in a different Ministry.

Academy of Scientific Research and Technology

The Academy of Scientific Research and Technology was established in 1971 as being the responsible body for science and technology in Egypt. Its functions are to:

--Support research toward solving problems of national priority;

--Encourage the application of modern technology in areas in the national programs of economic development; and

--Formulate policies that ensure strong linkage at a national level between scientific and technological organizations.

Its governing body is a Council of 44 members, 12 coming from university faculties and 10 senior scientists named by the president of the Academy, plus others from ministries within the government. The Academy has 11 specialized councils who identify problems, receive proposals and fund those considered superior.

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[1] Joint Agricultural Research - A Tool for Development Summaries in Cairo, Egypt. December 1981.

The Food and Agriculture Council is one of these 11. Currently it is funding 30 projects. These projects cover a wide range of subjects and presumably have the approval of the Ministry of Agriculture. Originally the Academy was concerned primarily with basic research but more recently a goodly portion of their funds have gone to support applied research and farmer implementation programs.

The Academy itself supports a wide range of committees that function much like the National Academy of Sciences in the United States. It also functions as a funding agency somewhat like the National Science Foundation of the U.S.

The Academy has a budget of 2,000,000 LE available for grants. Recent allocations for the support of research projects have been 40 percent to governmental ministries, 40 percent to universities and 20 percent to specialized institutes within its organization.

National Research Center

The National Research Center (NCR) is an autonomous body having its own laboratories, pilot plants and support facilities. Since 1975 NRC research activities have been client-oriented. NRC has established communication or collaborative relationships with a number of international research organizations.

Programs are organized around the following six areas of work:

Industrial
Food and Agriculture
Health
Energy
Natural Resources
Rural Development

The Center has a staff of 500 agricultural scientists, 200 of whom have Ph.D. degrees. Its agricultural research covers a wide range of subjects. More recently the Center has implemented what is called an integrated Rural Development Program where it is working with three governorates at the village level in assisting farmers to increase yields of maize and tomatoes. Health and education are also included in their "integrated" approach.

According to the President of NRC their uniqueness is the ability to develop multidisciplinary approaches to problem solving, to do contract research and to do both research and development. The Center receives funds from the Egyptian government as well as from foreign donors including AID. Much of the support comes from contract research, for both public and private organizations. The Center operates much like the Stanford Research Institute, Battelle, or the Research Triangle Institute except for the public funding. The budget for research and development in the agricultural area is approximately 1,500,000 LE, most of which comes from contracts.

The Center's linkage with agriculture is at the governorate level and not at the ministerial level, although there is a personal relationship with the Minister of Agriculture. In the field of agriculture the Center appears to be functioning where Extension has not performed.

Agricultural Extension

Agricultural Extension currently is handled by an Undersecretary for Extension within the Ministry of Agriculture. Its organizations and functions were recently discussed.[1/]

Universities with Agricultural Faculties

One of the great resources of Egypt is the system of higher institutions of learning in which 14 of them have faculties of agriculture.

[1/] "Increasing Agricultural Production Through More Effective Use of Technology," Report of a U.S. Extension Study Team. AID, U.S. Study Team, November, 1981.

Some have been in operation for many years and have large numbers of well-trained professors, for example, the Universities of Cairo, Ain Shams and Alexandria. Others have been established more recently and have smaller faculties. The following universities have faculties of agriculture:

CAIRO
FAYOUN (UNIVERSITY OF CAIRO)
AIN SHAMS
ASSIUT
TANTA (KAFR EL-SHEIKH)
MANSOURA
ZAGAZIG
MINIA
MENOFIA (SHEBIN EL-KOM)
ISMAILIA
AL AZHAR
HELWAN
ALEXANDRIA
MOSHTOHER (ZAGAZIG UNIVERSITY)

The universities are organized much like those in the U.S. with commodity departments such as horticulture and animal production and discipline departments such as soil science, agricultural economics and plant pathology. The University of Cairo offers the B.S., M.Sc. and the Ph.D. degrees in 22 disciplines. In addition, the University of Alexandria has a program in forestry and agricultural engineering. Apparently the others do not.

These 14 universities have large undergraduate enrollments and last year approximately 6500 received the B.S. degree in agriculture. The University of Cairo currently has 5000 undergraduates, Ain Shams 6000 and Alexandria 7000. Others have smaller enrollments. The larger universities also have large numbers of students working toward advanced degrees. For example, Cairo has 162 Ph.D. candidates and 402 working

toward advanced degrees but even the more recently established institutions have permission to offer the M.Sc. and the Ph.D. degrees. They also have a diploma degree which is a nonresearch-oreinted program designed for those desiring some technical knowledge.

Most of the graduate students are from Research Institutes within the Agricultural Research Center and the universities themselves. Those from the Research Institutes are permitted to do their thesis research at their respective institutes under the joint supervision of their major professor at the University and their supervisor at the Research Institute.

Those from the Research Institutes are never in residence on the campus but attend classes two days per week as permitted by their employers. Exceptions are made in two directions: Alexandria University does require a certain amount of residence, whereas some universities permit more flexibility for students commuting great distances in order to attend class.

Alexandria has an agricultural faculty with 300 Ph.D. degrees and the other two older universities have similar faculties. Many of the older faculty members have degrees from Western Europe and the United States. During the late nineteen fifties and sixties many attended the eastern European universities. More recently the percentage of faculty members going outside the country for training has been extremely small.

Teaching loads are standardized at 8 hours per week for a professor and more hours for the lower rank teaching. In reality, however, many teach more hours because of the large numbers of students and the salary incentives gained for additional teaching. A faculty member may also teach at institutions other than his home base. University policy not only permits but encourages working in other countries, primarily because of the increase in pay. In some cases staff members make as much as 15 times their pay at home. Some universities have 25 percent

of their faculty working outside the country. Leave can be extended up to four years.

Salaries are extremely low. The beginning salary for a professor is 120 LE per month; a typical salary is 200 LE and the maximum is 250 LE. Salary incentives are additional. These include extra teaching or other university duties, book sales, outside consulting (of which two days per week is permitted) and more recently affiliation with AID project

With the exception of the University of Alexandria, the laboratory equipment is most inadequate for the training of graduate students. Alexandria does have some highly sophisticated scientific equipment made available through PL-480 and other outside funds. Fortunately, many of the students pursuing advanced degrees have access to better equipment in their Research Institutes, but even there, equipment is not always adequate. Some of the equipment at Alexandria is not functional because of the inability to get it serviced.

The University of Cairo Faculty of Agriculture Library has about 28,000 books. Many are out-of-date and not all are classified. Much of the crowded space is used for the storage of theses. The faculty has about 5,000 LE annually for books and periodicals. The University of Ain Shams Faculty of Agriculture has some 50,000 volumes, but as at Cairo, much of the space is used by theses. Their annual budget is very limited at 5,000 LE. The library of the Faculty of Agriculture, University of Alexandria, is probably the best in Egypt. They spend approximately 17,000 LE per year for periodicals and books, but their building is most inadequate. We had no opportunity to visit other university libraries, but according to a study made by the University of California in 1981 we saw the best.

Faculty members, though trained for research, have little time for such activity except through their graduate students. This, of course, is significant. In addition, some of the larger universities

have a limited number of research grants from PL-480 funds or other foreign donors. Of the 11,547,279 LE PL-480 funds between 1961 and 1979, 36 percent went to the universities. However, this fund appears to be drying up.

A couple of the universities, namely Alexandria and Ismailia, have demonstrated an interest and a capability in Extension and rural development. But presently they have no official ties with the Extension Service.

C. MINISTRY OF IRRIGATION AND THE SUDAN AFFAIRS (MOI)

The MOI is responsible for the development of water resources and the construction and maintenance of irrigation and drainage works including main/branch canals and drains as well as pumping stations for New Lands. The MOI may alone authorize the taking of water from the Nile Basin waterways and exploitation and use of groundwater in the Nile Valley. Besides these specific duties with respect to irrigation and drainage, and its control of the releases downstream of Aswan, it is also responsible for Lake Nasser, and in cooperation with the Government of Sudan, for the development of water conservation projects in the Sudan.

As custodian of the nation's water resources, the MOI is also concerned with maintaining water quality, determining and establishing reasonable costs of water and service charges, and has played a continuous role in land reclamation. It is responsible for the allocation of water on which all land reclamation projects are based and decides upon the division of water supply between service areas, including the official irrigation requirements for each region by cropping season, administering the rotation system for the wet and dry periods, controlling the rice belt irrigation system, and maintaining the irrigation drainage pumps and systems.

The MOI runds experiment stations and conducts research. A chart showing the main departments and organizations operating under the

administrative jurisdiction of the MOI is attached (Figure 2).

D. MINISTRY OF RECONSTRUCTION AND LAND RECLAMATION (MLR)

The MLR has two subministers--one for reconstruction and one for land reclamation (MLR). It is the functions of the subministery for land reclamation that are of prime concern to the MOA.

The MLR has overall responsibility for drawing up, planning and implementing all works for New Lands reclamation below the main/branch canals and drains, including infrastructure, housing, and agriculture on all these lands. The MLR coordinates its work with the MOI, which is responsible for construction of main/branch canals and drains and main pumping stations. The MLR is directly responsible for irrigation projects in the New Valley and desert areas outside the Nile Basin. Once development plans are approved, the work is entrusted to land reclamation companies, directly responsible to the MLR. After the land is reclaimed, it goes to agricultural companies for cropping, welling or distributing. These companies are responsible to MLR.

E. MINISTRY OF SUPPLY

The Ministry of Supply is responsible, among other things, for functions in the fields of purchasing, internal marketing, distribution and storage of consumer goods and control over their prices. This Ministry is also involved in setting prices paid to farmers for their products. In rice, for example, it collects the quotas from farmers, takes it to the mill, processes it and distributes it to the consumer through a ration card system. Thus, it is heavily involved in policy decisions relating to cropping systems involving mandated crops, and in determining each returns to farmers for their crops.

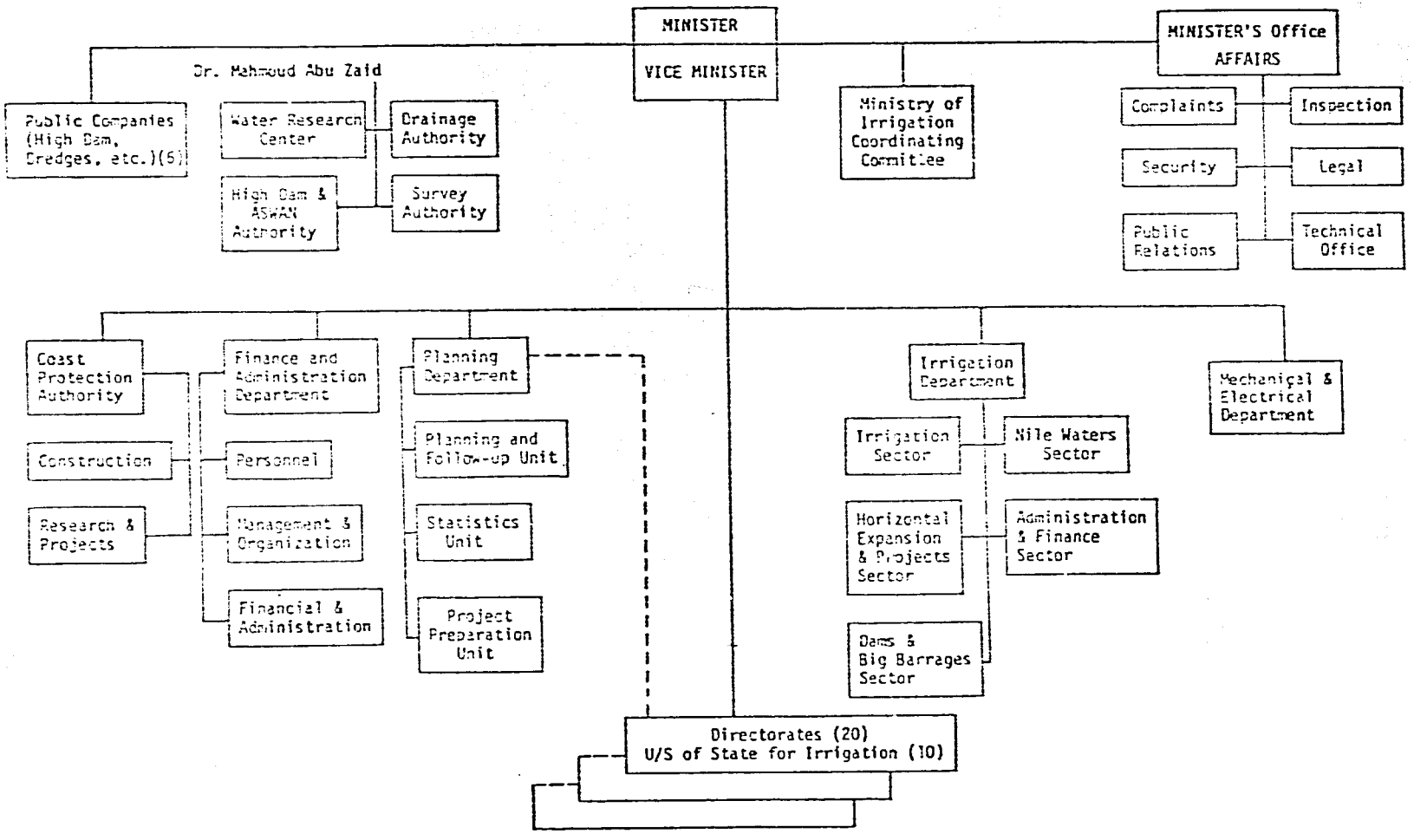

FIGURE 2 ORGANIZATIONAL SCHEME - MINISTRY OF IRRIGATION.

I. CONSTRAINTS AND RECOMMENDATIONS

A. POLICY

1. The government of Egypt's policy of having the functions of the ariculture sector distributed among a large number of ministries in many cases, causes inefficient, overlapping and conflicting goals in developing and carrying out agricultural policy.

2. Implicit taxes, production controls, mandatory deliveries to the government and input subsidies are among the major constraints to accelerating agricultural development. More national resources need to to into rather than out of the agriculture sector. (See policy discussion)

B. INSTITUTIONAL AND ORGANIZATIONAL

The institutional and organizational constraints can be divided into two categories: BETWEEN Ministries, and WITHIN the Office of the Minister of Agriculture and WITHIN the Ministry of Agriculture.

1. Between Ministries:

While the Ministry of Agriculture has the prime responsibility for domestic food production and national food security, the Ministries of Irrigation, Land Reclamation, Supply, and to a lesser extent Planning, Economy, Industry, Transportation and Treasury all perform important function which affect the agricultural sector either directly or indirectly. Thus, the administration of agricultural policy and the conduct of various agricultural plans is complex, and in many cases inefficient with overlapped and conflicting goals.

If the agricultural sector is to meet the future goals of food production, it is necessary that all facets of the agricultural sector be considered in a holistic framework for planning and

execution of national programs. An example of a specific conflict is the price paid to farmers for mandated crops. At present, the suggested cropping system and proposed prices to be paid to farmers is first developed by the MOA. These are then reviewed and adjusted by the cabinet Ministers, leaving some discretion to the Ministry of Supply (except for cotton where the Ministry of Economy has major authority for setting price) for the price paid to the farmer.

The Minister of Finance, the Minister of Supply and the Minister of Economy are frequently at odds with the Ministry of Agriculture on the levels of price to be paid to the farmer. The Ministry of Agriculture usually desires a higher price but is often defeated by the Cabinet. Also, the tendency for the Ministry of Supply is to pay the lowest possible price. Since the income to the farmer from the mandated crops is nearly always less from alternative crops, the farmer has little or no incentive to do his best on mandated crops. There is a need for a better understanding of this problem by the cabinet Ministers.

Since food and agriculture are of such great importance to all of Egypt, some method that would provide for all ministries concerned with the agricultural sector to focus regularly on the agricultural sector would be desirable.

There are a number of mechanisms that could assist in the coordination or development of an integrated holistic approach to the problems of the agriculture sector. Three possible mechanisms are discussed below:

a. <u>Better cooperation through personal rapport of the Ministers and Undersecretaries of the involved Ministries</u>.

This would probably require person-to-person contact by the Ministers as well as certain Undersecretaries on a regular and frequent basis--possibly as often as every two weeks--to focus

on joint issues and to develop the personal rapport necessary for success. Even with the best of intentions compatible personalities would play an important role in the success of such relationships. It would necessitate not only strong personalities but a high level of discipline for the Ministers in relation to the operation of their own Ministries. This mechanism would make possible cooperation and coordination, but it would not assure it.

b. The establishment of a Supreme Council of Ministers for Food and Agriculture.

This council would be composed of those Ministries that are directly involved in the agricultural sector (Ministries of Agriculture and Food Security, Irrigation and the Sudan, Reconstruction and Land Reclamation, and Supply) as primary members and those other ministries that are also concerned with general or specific functions bearing on the agricultural sector as secondary members (Ministries of Planning, Economy, Industry, Transportation and Treasury).

Since Food and Agriculture are of such great importance to all of Egypt, a more positive and formalized method than now exists that would allow all ministries concerned with the agricultural sector to focus regularly on the agricultural sector would be desirable. Under this mechanism the primary members would meet frequently and the secondary members would meet less frequently with the entire group possibly every other meeting. The primary members probably should meet no less than four times a year, with the full council members meeting twice a year. This mechanism would, at least, give all ministries involved in the agricultural sector an opportunity to bring their various concerns to the attention of ministers with related interests, even though some may be in conflict. It should be an improvement over the present situation, even though it is a more

passive than positive mechanism.

c. Establish a formal structure of ministries directly concerned with the agricultural sector (Ministries of Agriculture and Food Security, Irrigation and the Sudan, Reconstruction and Land Reclamation, and Supply) under a Deputy Prime Minister for Food and Agriculture. As indicated earlier, food and agriculture is of major concern and of high priority to the national government. It would appear that immediate action at the highest level of government is necessary to accelerate agriculture development and meet the food and agricultural goals of Egypt. The establishment of a Deputy Prime Minister for Food and Agriculture would provide for both a positive and formal mechanism to assure joint consideration of the policies and goals of this sector, by the Ministries directly involved. This mechanism would provide for both cooperation among ministries and positive action by the Deputy Prime Minister. It should provide a mechanism that would assure a holistic approach to the agriculture sector.

GENERAL RECOMMENDATIONS:

- Appoint a Deputy Prime Minister for the Food and Agriculture Sector. The Ministries of Agriculture and Food Security, Irrigation and the Sudan, Reconstruction and Land Reclamation and Supply would report through the Deputy Prime Minister for Food and Agriculture. Also encourage the development of better rapport among these Ministries by frequent meetings of the Ministers and appropriate Undersecretaries.

- The Ministry of Irrigation has the responsibility for irrigation and drainage canal systems, for delivery of water to the lands, and for removing the drainage water. There are disagreements between the MOI and MOA on some items that relate to irrigation and drainage. For example, water is not always in the canals as early as needed

for some farming systems. The complaint is made that the openings in some branch canals are not large enough within the time frame to allow sufficient water for some of the newer cropping systems, thus limiting crop yields on these lands. It is not infrequent for farmers near the openings on branch canals to take water beyond their needs and the farmers at the end of the water course to have insufficient water, thus causing a misuse of water at both ends. Both ministries conduct research on water use and water requirements of crops. There is a need for closer working relations between MOI and MOA on all water activities that relate to crop production. This should be a formal relationship and be operative at the national governorate, and district levels.

RECOMMENDATIONS: MOA AND MOI

- In order to insure joint attention to specific projects, it is proposed to establish an interministerial work group between the Minister of Agriculture and the Minister of Irrigation. This Agricultural-Irrigation Work Group would be activated at the national, governorate and district levels. Its prime purpose would be to focus on the interface between the responsibilities of the Ministry of Agriculture and the Ministry of Irrigation, and determine where the policies and operations of each Ministry could aid in accelerating agricultural development.

- Most of the meskas are in poor repair and are below grade. They should be raised and straightened with adequate outlets so that farmers can irrigate efficiently. The farmers are not getting the help they need from either ministry on this problem.

The Ministry of Reconstruction and Land Reclamation is responsible for the development of the infrastructure and irrigation works on New Land. They also are responsible for managing the lands after they are developed. At the present time the Ministry of Agriculture is not fully

involved in the selection of land to be developed or in providing guidance and services to the lands after they are developed. Again a formal relationship should be developed between the Ministry of Reconstruction and Land Reclamation and the Ministry of Agriculture for planning, administration and services of these areas. Most of these lands are in the sandy areas of the desert and there is a great lack of research information on what crops are best adapted, the best cropping systems, timeliness and amounts of water application, fertilizer requirements, etc. All services of the Ministry of Agriculture, such as research, extension, cooperatives, etc. should be made available to the farms of these areas as soon as the lands are available for cropping.

RECOMMENDATIONS: MOA AND MLR

- In order to insure joint ministerial attention to specific projects it is proposed to establish an interministerial working group between the Ministry of Agriculture and the Ministry of Reconstruction and Land Reclamation. This Agricultural-Land Reclamation Work Group would be activated at the national, governorate and district levels. Its prime purpose would be to focus on criteria and selection of New Lands to be reclaimed for irrigation agriculture and on those interface areas of mutual concern relating to accelerating agricultural development.

- The MOA should establish a research and demonstration farm, in cooperation with MLR, on the areas selected for irrigation a minimum of five and presferably ten years before the land is fully develop'd for farmer use. This should provide the needed technology for profitable agriculture.

2. <u>Within the Ministry (and Office) of Agriculture and Food Security</u>:

A major problem limiting the effectiveness of the organizations and institutions serving agriculture and indirectly constraining agricultural development is the way that agencies are currently

organized, within or associated with the MOA.

In many countries, all farm production is privately operated. Where that is true, the Ministry of Agriculture normally has four main responsibilities.

--To assure that all of the support services that farmers need are being provided either through public agencies or by private enterprises;

--To administer all of those support activities that are not provided by private enterprises or by agencies of other Ministries;

--To administer laws and regulatory functions relating to agricultural production, processing and distribution; and,

--To participate in making adjustments of various types between agriculture and other sectors of the economy.

The support services referred to above are of five types:

--research with respect to crop and livestock production and to economic problems related to agriculture;

--assuring adequate wholesale supplies of farm inputs;

--achieving an effective set of agricultural support activities throughout the countryside so that all farmers have easy access to all of them. Those support activities include:

(a) arrangements for the retail distribution of farm inputs;
(b) arrangements for the local availability of farm credit;
(c) a corps of agricultural extension agents;
(d) adequate local marketing channels for farm products; and,
(e) adequate arrangements for local transportation between farms and market towns.

--assuring that there are adequate incentives for farmers to increase production, and to administer laws and regulations affecting agriculture; and,

--a program of land development, including irrigation, drainage, landshaping, land amelioration, etc.

It is well to keep in mind these normal responsibilities of a Ministry of Agriculture in countries where all farming is privately operated. But there are two major reasons why the present pattern in Egypt is much more complex.

One reason is the magnitude of the land development program and the many specialized but highly complementary activities that are involved in it, especially in the New Lands. Responsibility for those activities has been divided among the Ministry of Agriculture and Food Security, the Ministry of Irrigation, the Ministry of Reconstruction and Land Reclamation, and the Ministry of Supply. Together, but under separate administration, they have the task of bringing New Lands into full production. The other reason for the complexity of the present system results from the introduction of state farming. Each of the state farms has to be managed, and that raises the question of who is to administer these farms, and how.

In addition there are a number of semi-autonomous agencies, of which the Minister of Agriculture is Chairman, but which are not part of the Ministry of Agriculture. Once the precedent of such semi-autonomous agencies was established several such agencies were set up to perform certain functions which would normally be activities of the Ministry of Agriculture--or, of private enterprise--such as procuring fisheries equipment, producing horticultural planting materials, supplying funds for farm credit to the cooperative societies for distribution to farmers, or managing a cattle insurance fund.

The Agricultural Research Center was set up as a semi-autonomous agency to give it more freedom from normal governmental operating procedures. This is a pattern that has been followed successfully in many developing nations in the past decade to accelerate a sustained flow of production technology.

These various developments have resulted in a rather complex set of allied agencies, too numerous and diverse for efficient management.

Meanwhile, the Ministry of Agriculture continues to be organized into 13 Undersecretariats with considerable overlapping of function with the allied organizations and companies. Five of these Undersecretariats provide services to farmers:

PEST CONTROL
VETERINARY SERVICES
SEED PRODUCTION
COOPERATIVES responsible for input and credit distribution (with funds for farm credit provided by the Principal Bank for Development and Agricultural Credit, which is a semi-autonomous agency) and marketing of regulated farm products, mainly cotton, rice and wheat.
AGRICULTURAL EXTENSION

Four other Undersecretariats include some services to farmers but have more general responsibilities with respect to production, distribution, marketing and some regulatory functions:

HORTICULTURE
ANIMAL PRODUCTION
FISHERIES
AGRICULTURAL ENGINEERING

Four Undersecretariats have mainly "staff" functions:

FOR THE MINISTER'S OFFICE
FOREIGN AGRICULTURAL RELATIONS
AGRICULTURAL ECONOMICS
MANAGEMENT DEVELOPMENT

The present collection of 17 semi-autonomous organizations and companies, and the 13 operating Undersecretariats does not permit effective management and operation of the Ministry.

The present organization precludes the sharp focus of attention on priority functions of the Ministry. It also causes inefficiencies because of ovelapping or duplication of functions, as well as uncertainty

about responsibilities of the various agencies.

RECOMMENDATIONS:

- There should be a restructuring of the MOA, to ensure effective attention to the essential functions and services of the Ministry and to eliminate the nonessential functions.

  Primary functions of the Ministry would include:

  --determining requirements, goals and services for the agricultural sector, with attention to policies and incentives to ensure a productive and profitable agriculture--planning and budgeting;

  --providing a continuous flow of improved technology, including the field evaluation, extension, and use of such technology by farmers--research and extension;

  --ensuring adequate and timely supplies of production inputs to farmers;

  --developing and maintaining infrastructure for support services, including production and marketing;

  --improving and maintaining the productive use of land and water resources; and,

  --administering the laws and regulations relating to agricultural production, processing and use.

  There are additional aspects of agricultural production and development but the major functions and activities of the MOA would be embraced within the foregoing categories.

  The primary objective of developing an organization and management structure within the Office and Ministry of Agriculture is to assist in achieving the agricultural goals in a most effective manner. There are many ways of developing such a structure or organization,

but regardless of how it is done it should provide for easy focus, in an organized non-duplicating manner on the main objectives and responsibilities of the overall organization. The organizational structure being suggested here is just one of many ways of accomplishing this task.

The present structure of the Ministry, including the allied organizations and companies, is shown in Figure 1, page 3. The suggested revised organization is presented as Figure 3. This provides for the major functions and responsibilities as listed above and accommodates the activities of both the component Undersecretariats and the allied organizations and companies. The recommended organization consists of:

(a) selected semi-autonomous bodies--as companies and authorities, with the exception of the Agricultural Research Center chaired by a First Undersecretary;
(b) the Agricultural Research and Extension Authority chaired by a First Undersecretary;
(c) a First Undersecretary for the Ministry of Agriculture with five component units; and,
(d) six staff offices serving or related directly to the Minister.

Reference to Figure 3 will facilitate the review of the functions of the agencies or units within these three categories.

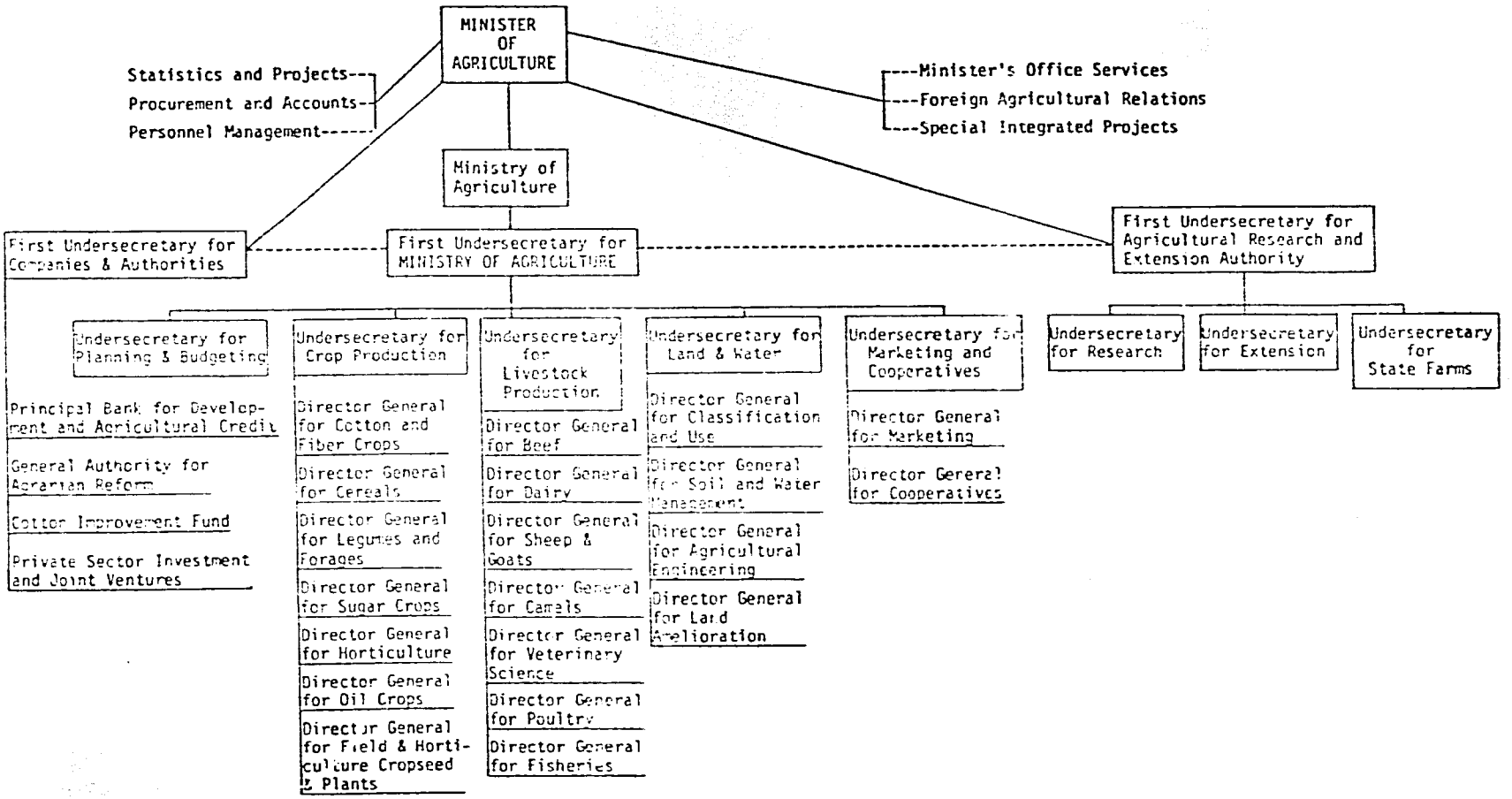

FIGURE 3 PROPOSAL FOR A RE-ORGANIZED OFFICE OF THE MINISTER OF AGRICULTURE AND FOOD SECURITY.

FIRST UNDERSECRETARY FOR COMPANIES AND AUTHORITIES

As discussed earlier, there has been a proliferation of semi-autonomous organizations established over a period of years when it seemed that expansions in agriculture and new farming systems best would be served by such agencies. A number of these have important functions that should be continued in the semi-autonomous company or authority. Others should be modified--as private sector organizations, or considered for joint ventures.

1. Principal Bank for Development and Agricultural Credit (PBDAC)

This is an extensive credit system, with 17 governorate banks (BDAC), 130 branches of the BDAC, 740 village banks and about 4200 agencies serving farmers and cooperatives at the village level throughout the country. The Bank is the major source of credit for farm machinery, soil amelioration, livestock and poultry production, fertilizers, seeds, etc. The local branches and agencies are essentially farm supply stores. While there have been some criticisms about the management and service of some of the agencies, with delays in delivery, etc. the overall system seems sound and should remain associated with the MOA.

The Cattle Insurance Fund (CIF) should be merged into the PBDAC. Although this insurance theoretically is optional it is required if funds are borrowed for purchase of cattle or feed. There is not apparent justification for maintaining the CIF as a separate company.

2. General Authority for Agrarian Reform

This organization was established to handle the distribution of 1,000,000 feddans to small farms. There are cooperatives, marketing services and other functions handled by the approximately 40,000 employees of the Authority. It would appear that certain of the activities and services should be consolidated with or coordinated

more effectively with other agencies involved with similar functions. It is the firm view of the Minister of Agriculture that this organization has a most significant role in carrying out the programs of the MOA and should be continued.

3. Cotton Improvement Fund

The special cess or tax to provide support for cotton research has been an important factor in ensuring the stability and scientific stature of the research that has gained Egyptian cotton its position of eminence around the world. There may be a question of continuing this fund but from experience in countries where such funds are established it is recognized that they are very important in maintaining an effective research capability. It is recommended that the fund should be continued.

4. Private Sector and Joint Ventures

This office would be a source of information, encouragement and possibly capital or credit for attracting private capital, both foreign and domestic for private as well as joint venture undertakings. A number of the present companies and authorities are engaged in commercial type ventures that would seem to have limited relevance to essential functions of the MOA. Some of these might be discontinued or shifted to the private sector. Others might best be handled as joint ventures, involving either domestic or foreign capital, or a combination of both.

The companies involved include:

a. High Seas Fishery Company. This company fishes on the high seas and sells its catch to the Ministry of Supply.

b. North Fishery Company. This company fishes in the Mediterranean area and sells the fish to the Ministry of Supply.

c. Fishery Equipment Company. The company purchases and provides fishing equipment for fishing companies and small fishermen.

d. General Company for Meat Production. The company produces meat and milk, and also provides improved breeds. It has several farms, purchases and fattens calves, and sells to the Ministry of Supply.

e. General Company for Poultry Production. The company provides basic needs--day-old chicks, feed, etc.--to broiler firms and also on demand to small poultrymen. The company produces broilers which are sold to the Ministry of Supply. Private broiler companies and poultrymen can sell on the open market.

f. General Authority for Agricultural Stabilization. This agency provides subsidies for fertilizers, pesticides, etc. especially for cotton and soybeans. It also furnished guidance in determining import requirements.

g. Egyptian Agricultural Authority. This agency imports seeds, mainly vegetable seeds, and some machinery and fertilizer. Fertilizers are provided to farmers with a 50 percent subsidy, and on a basis that permits farmers to obtain larger supplies of fertilizers than might be available from the Principal Bank for Development and Agricultural Credit and the Agricultural Cooperatives.

h. Nubaria Company for Seed Production. This is located on newly reclaimed desert lands and the company propagates and increases foundation and other seeds of selected vegetable crops.

i. West Nubaria Agricultural Company. The company operates a large farm of 10,000 feddans on newly reclaimed land. It sells products to the Ministry of Supply but can also sell on the open local markets.

j. Egyptian Company for Vines and Distillation. This is an agro-industrial company, with its own land, that produces grapes for table use and wine. The company cooperates with the Agricultural Research Center. It does its own processing and marketing.

FIRST UNDERSECRETARY FOR THE MINISTRY OF AGRICULTURE

This office would be responsible for the management of the Ministry of Agriculture and would be composed of five undersecretaries as follows: Undersecretary for Planning and Budgeting, Undersecretary for Crop Production, Undersecretary for Livestock Production, Undersecretary for Soil and Water, and Undersecretary for Marketing and Cooperatives.

The Ministry of Agriculture needs an Undersecretary for Planning and Budgeting with planning procedures that involve economists and other specialists concerned with the programs of the Ministry. The office would be responsible for assembling and integrating funding needs and recommending budgetary allocations among the undersecretariats over which the Minister of Agriculture has administrative control. It would also serve the Minister in preparing information related to resource allocation questions conserning the semi-autonomous agencies on which he serves as Chairman. However, those semi-autonomous agencies would prepare their own budgets and seek their own financial support as at present.

There are three major components in agricultural planning and budgeting. One is to plan what activities each agency related to agriculture should undertake within the ensuing fiscal period. This should take into account (1) the needs of farmers and of the national economy and (2) the existing manpower and managerial capacity of each agency available for employment in those activities. The persons who are best qualified to do that kind of planning are the technical personnel of the extension service.

The second component in agricultural planning is to adjust the appropriate magnitude of the program of each agency, taking into account the complementarities among the activities of the various agencies. Trying to strike the optimum here is essentially an economic (not a financial problem), and while economists need to be involved, the technical personnel of each agency must participate also.

The third component has to do primarily with reconciling overall public expenditures in support of agriculture with the amounts to be spent in support of other sectors of the economy. This involves a combination of economic and public policy questions in which personnel of related ministries also must participate. The Ministries of Finance and Planning would have the dominant role, but Agriculture should be included in the deliberations.

It is assumed that there will continue to be an Agriculture Economics Research Insstitute within the proposed Agricultural Research and Extension Authority. It is there--and in the universities--that ongoing research on various agricultural economic topics should be conducted. But it is important that there also be a unit in the Ministry that is in a position to gather economic information quickly and formulate alternative lines of action for consideration by the Minister. This function would also be carried out in this office.

UNDERSECRETARY FOR CROP PRODUCTION

A number of Ministries are involved in the agricultural sector--in water development and management, in soil reclamation and management, in supplies, marketing, etc. However, the Ministry of Agriculture is the organization ultimately responsible for carrying out the programs that must achieve the agricultural production goals and achieve food security.

The success of a National food and agriculture program is measured in large part by the quantity and quality of the commodities available at harvest, for domestic consumption and for international trade. Production goals; enforcing rules and regulations; provision of inputs, supplies and services; and the harvesting, processing, transport, storage and distribution of agricultural products are all "commodity-oriented."

The organizational units within the Crop Production Undersecretariat would be responsible for integrating the wide variety of activities

related to the meeting of targets for the respective crop products.

This undersecretariat would have seven Director Generals concerned with the following: Cotton and other fibers, Cereals, Legumes and forages, Sugar crops, Horticulture, Oil crops, Field and Horticulture crop seeds and plants (this would include the function of the former General Department for Seed Production).

UNDERSECRETARY FOR LIVESTOCK PRODUCTION

The functions and responsibilities of the Livestock Production Undersecretariat would be similar to those of the Crop Production Undersecretariat. The seven relevant and significant disciplines involved with animal agriculture would be headed by a Director General and are: Water Buffalo and Beef, Dairy, Sheep and Goats, Camels, Veterinary Science, Poultry and Fisheries.

The Livestock Production Undersecretariat includes Veterinary Services since it is essential that animal health and quarantine functions be closely allied to all aspects of animal production and marketing operations.

The Fisheries Unit in this Undersecretariat would be responsible also for aquaculture.

UNDERSECRETARY FOR LAND AND WATER MANAGEMENT

Land and Water are the most critical resources for Egyptian agriculture. Yet, the responsibility for land and water development and use are dispersed among the Ministry of Agriculture, the Ministry of Irrigation, and the Ministry of Reconstruction and Land Reclamation.

It is recommended that there should be a unit concerned with Soil Classification and Use, to give attention to a) suitability of new and reclaimed lands for agricultural purposes, and b) the identification of

land areas to be conserved or protected against encroachment of housing and industrial development, brickmaking, etc. The latter problem must be faced at the highest levels of government, and by a broad spectrum of Ministries. However, the MOA should have a strong capability in the land classification and use area. The research function for soil classification and use would continue in the soil sector Research Institute.

The Soil and Water Management unit including farming systems would be concerned with on-farm water management, soil fertility and the relation of these to various crops and farming systems. Farming systems are being developed in new or reclaimed areas through various projects and experiments to determine soil and water management practices. It is desirable, however, to ensure a systematic and integrated program for the various kinds of crops, the combinations of crops, the soil management practices, and the water use and management practices, that will maximize the use of the land and water resources. It seems appropriate that the MOA should have a strong capability and position of leadership in these activities. This unit should work closely with the Soil and Water Research Institute.

It is proposed that the current Undersecretariat for Agricultural Engineering be included with the soil and water programs since much of the mechanization and other application of engineering principles to agriculture relates to irrigation farming. The agricultural engineering activities do, of course, transcend soil and water management but these can be undertaken by cooperative outreach of the proposed Agricultural Engineering Director General.

Machines and Equipment are being acquired in large quantities as production and other aspects of the agricultural sector are being increasingly mecahnized. This requires greater attention to determination of specifications and models, etc., to minimizing the number of sources and makes of tractors and machines imported or produced, and the ensuring of spare parts, repairs and maintenance services.

The Land Amelioration Director General would handle some of the functions of the present General Authority for Executive Body of Land Amelioration. This includes routine soil analyses, subsoiling, drainage, gypsum applications, etc. Some of these activities might be merged into the Soil and Water Management unit.

Other activities of the agency might be transferred to the Soils and Water Research Institute of the proposed Agricultural Research and Extension Authority. This Director General should continue the close working relationship with the Soil and Water Research Institute of the AREA. It could well take on the action function involved in reconstruction of the meskas and other implementation for good irrigation and drainage management.

The foregoing Deputy Generals to be placed under the Undersecretary for Land and Water Management include some new units or functions and some present agencies that have activities largely within this subject area. Special attention will have to be given to the alignment of specific functions within each Director General to ensure a desired level of integration. The establishment of the Undersecretariat for Land and Water Management will facilitate the effective involvement of the MOA in the proposed interministerial Work Groups, with the Ministry of Irrigation and with the Ministry of Reconstruction and Land Reclamation--in addressing issues of mutual concern.

UNDERSECRETARY FOR MARKETING AND COOPERATIVES

Marketing of agricultural products has received little attention in Egyptian agriculture. Nearly all aspects of post harvest technology are in short supply. A Marketing Research Institute is being suggested as an addition to the AREA to provide new and needed technology, but some method of assisting farmers and business men in this area is also greatly needed. An Undersecretary for Marketing and Agricultural Cooperatives should provide the needed organizational structure to accomplish this. The Director General for marketing would provide assistance in

the newly developed technologies relating to storage, transport, grading, quality control and other aspects of marketing. Methods of packaging of farm products, such as tomatoes, to prevent damage in transport, increased efficiency of the transport, development of more competition at the middleman level are just some of the urgent needs in this area.

The Director General for Agricultural Cooperatives will have the responsibilities of the present Undersecretariat for Agricultural Cooperatives. In reviewing the functions of some of the semi-autnomous agencies it appears that there are some activities that should be more closely integrated, or possibly transferred to the Undersecretariat for Agricultural Cooperatives. At least this warrants attention.

Consideration should be given to transferring much of the purchasing and distribution of inputs down to the district level to private enterprise. Whether the private sector is involved or not, however, some agency needs constantly to monitor what is happening to supplies of all inputs and to their distribution. More consideration should be given to marketing cooperatives, which are farmer owned and where farmers are responsible for management. Consideration could also be given to consumer cooperatives.

FIRST UNDERSECRETARY FOR AGRICULTURE RESEARCH AND EXTENSION AUTHORITY (AREA)

The Agricultural Reserach Center is now a semi-autonomous agency, while agricultural extension is handled by an undersecretariat of the Ministry. It is essential to handle the research for development of improved technology, the field evaluation and verification, the local testing and demonstrations, and the farm application and use, as a continuous process. This situation was reviewed in the study of the extension program in Egypt in 1981 and it was recognized that the research and extension activities should be brought together.[1/]

[1/] "Increasing Agricultural Production through more Effective Use of Technology." Report of a U.S. Extension Study Team, November, 1981. AID.

The recommendation for the combining of agricultural research and extension, includes also the recommendation that the General Authority for Agricultural Production (GAAP) be consolidated into a new Agricultural Research and Extension Authority. The GAAP operates the lands for the research stations and also increases foundation and other seeds. This creates a serious conflict on decisions for priority use of the lands--for research or for seed production. More importantly, field experiments not reliable because of uncertainty about the previous treatments--fertilizer applications, etc.--of the plots. The continuing seed production function of the GAAP should be reviewed and coordinated with the Undersecretariat for Crop Production after the GAAP is transferred into the Agriculture Research and Extension Authority.

AGRICULTURAL RESEARCH

Since the Agriculture Research Center and the Undersecretariat for Extension Service are so closely related, they are discussed together. For the same reason university research and teaching are also discussed here even though these are not in this Ministry.

AGRICULTURAL RESEARCH CENTER

The Research Institutes seem to operate as independent and autonomous bodies with inadequate relationship to research needs of the country. This is true at the Institutes and at the Research Stations where research scientists are located.

The Deputy Chairman needs a better mechanism for coordination between commodities and disciplines.

The programs are overstaffed and underfunded. Facility inadequacies include more space, more equipment, especially in the laboratories, transport, and travel funds. The library is short on books and journals and a better mechanism for making material available to the

field staff is needed.

Salaries are not sufficient to attract and retain the outstanding people required to provide the quality of research imperative for meeting the food needs of the country. Not only is the base salary far too low but the salary-incentive system tends to dissipate the energy and interest of researchers and detract from their primary job. Furthermore the use of longevity as the primary measure for promotion leads to mediocrity rather than efficiency.

The present system of providing graduate training, though commendable, will eventually lead to excessive inbreeding and a loss of quality. Ways should be explored, through foreign donors or otherwise, to send a larger number of the more promising young scientists overseas for training. Some could be for actually working toward a degree and others as post doctorates. At the present time approximately 90 percent of the research staff has been trained locally.

A basic deficiency in the system is the inability of the ARC to control its own land, farming schedule or equipment. The present arrangement encourages the emphasis to be put on economic returns from the sale of products rather than achieving the objectives of the experiment. Furthermore, having land allocated for research without knowing the history may actually invalidate the experimental results.

Not only are the research workers isolated from other related disciplines but they also have little linkage with extension. A logical relationship between research and extension should provide feedback in both directions. Closer association between the two would be equally mutually advantageous to both.

The present system of spending as much as 25 percent of the researcher's time in the field assisting farmers during the growing season is an expensive and inefficient use of his time. Neither is it training the extension person for future assignments.

AGRICULTURAL EXTENSION

The status of Agricultural Extension in Egypt was recently described by a joint Egyptian-U.S. Team.[1] Perhaps the greatest single constraint to building an effective extension staff is the employment policies of the country. The agency has no opportunity to select its personnel but must take recent university graduates regardless of their qualifications. A recent study by the Extension Research Institute concluded that 84 percent of a certain group allocated to Extension were unfit for their jobs and even after further training 60 percent were still not qualified for the roles they were expected to play. The general impression gained from personal interviews was that Extension was less attractive to prospective employees than other units within the Ministry. Low salaries were often mentioned as a cause of low performance. Not only is the Extension Service ineffective in recruiting but their failure to retain their more productive workers is in the long run a greater constraint. Extension workers also have inadequate support in the way of demonstration material, supplies and even travel in many instances.

There are no subject matter specialists capable of translating research into village level comprehension. The staff from the national level to the village level is essentially made up of university graduates with a B.S. in agriculture, many of whom have had no farm experience. Furthermore, there is no formalized program of in-service training.

Linkage between extension and research is weak and casual. They are not housed together and this lack of interchange of information is a detriment to both extension and research.

AGRICULTURAL SECONDARY HIGH SCHOOLS

The 59 Agricultural Secondary High Schools are attempting to teach 76,000 students with poor equipment and in crowded facilities. The

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[1] "Recommendations for a Strengthened Agricultural Extension Program in Egypt," BIFAD, November 1981. AID.

curriculum has been recently revised to allow for practical training but the policy of permitting 50 percent of farm profits to go to the teachers is not conducive to objective teaching.

RECOMMENDATIONS

- The Agricultural Research Center should be expanded into the Agricultural Research and Extension Authority, including Extension and the state farms. (Figure 4, AREA) The Minister would serve as the Chairman with a First Undersecretary for the day-to-day operations. Each of the three units--Research, Extension and State Farms--would be headed by an undersecretary. These four individuals would serve as the board for coordinating the three functions at the national level. There would be an Advisory Council, consisting of the Minister, First Undersecretary, the Undersecretaries for Research, Extension, and State Farms, plus 2 from the university community, 2 farmers (producers), 2 from consumer groups and one from the Academy of Scientific Research and Technology. The function of such a council would be entirely advisory and would serve to identify high priority research and extension needs. It would not establish policy or participate in administrative decisions. Members would be appointed by the Minister (except those by virtue of their positions) and would serve at his discretion.

- The Research unit would be called the Agricultural Research Service. The Undersecretary would have three directors, one for administration and financial affairs including the library, one for program development and coordination, and one to be responsible for interdisciplinary research. The Research Institutes would remian essentially as they are at present except that the Extension Research Institute would be replaced with a Rural Women and Development Research Institute and program evaluation functions of the Extension Research Institute would be transferred to the Undersecretary for Extension. The Rural Women and Development Research

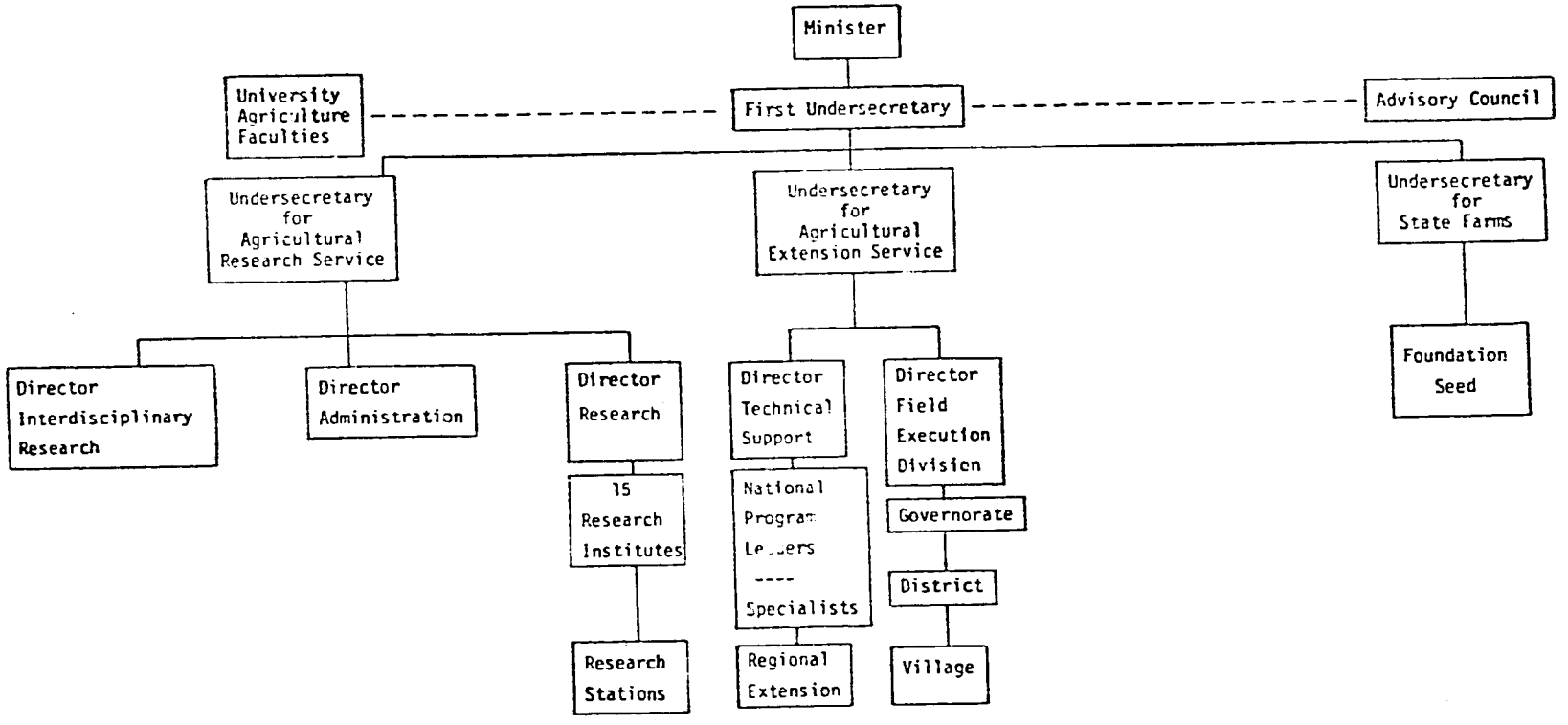

FIGURE 4 AGRICULTURE RESEARCH AND EXTENSION AUTHORITY.

Institute would be charged with providing a research base for strong extension programs directed toward impact and role of women in development and increased agricultural productivity and the improvement in the quality of rural life.

- A Marketing Research Institute should be established to conduct research in all aspects of marketing including post harvest losses, transportation and housing. Activities would include both the biological and economic problems associated with marketing.

- We were unable to visit many of the research stations and so have no recommendations to make regarding their specific consolidations. In principle, however, an effort should be made to combine the field crops, horticultural and livestock stations into multipurpose stations to serve the type of farming within the area. This would allow far more efficient use of the facilities, including housing, laboratories and libraries.

- National research and development teams for all of the major commodities would be organized for the purpose of identifying the major research needs of that particular commodity, outlining research methods for developing the necessary technology and implementing the research according to agreed-upon procedures. Membership would include representatives working on that particular commodity or individuals having a potential for contributing, including representatives from the university community. Specific disciplines needed for the particular commodity would be included. For example, the "All Egypt Major Cereals Team" would logically include scientists trained in breeding, agronomy, soils, plant pathology, pest control, agricultural economics, and mechanization, plus the national extension program leader in maize. The team leader would be designated by the Director for Interdisciplinary Research, Agricultural Research Service, and operate out of his office. The function of the extension program leader would be to provide linkage between research

and extension. Sufficient unallocated funds would be provided the committee from the Undersecretary's office to accomplish the objectives of the experiment The team would meet as often as necessary, but at least once a year, to review the results and plan succeeding work.

- Sub-teams would be formed at the research stations that conduct work with maize. Members would represent the same disciplines as for the national team, the regional maize extension specialist, and someone from the university community whenever appropriate. Funds would be made available from AREA for the expenses necessary to do the work including previously agreed-upon salary incentives. Members would be in continuous contact with each other in order to conduct multidisciplinary research. They would operate under the general guidelines developed by the national team. The team leader would be designated by the Director for Interdisciplinary Research, Agricultural Research Service. The results would be summarized annually and made available to the national team. Other teams would be organized along similar lines.

- Participation of university professors would depend upon the importance of the commodity in their area, the capability of the professor and his interest in collaborating in national research programs. Expenses that he would incur, including salary incentives, would be provided by the AREA.

- A unit would be established in the Undersecretary's Office to serve two primary functions, namely: (1) to implement the programs of the multidisciplinary research and development teams and (2) to administer a competitive grants program to support research at the universities for specific studies. This office would have funds for supplementary needs beyond those coming from the Research Institutes, including salary incentives.

- Recommendations of the U.S. Extension Study team to the Ministry of Agriculture and the U.S. Agency for International Development (November 1981) have been favorably accepted by both governments. A subsequent study team on "Implementation of a Strengthened Agricultural Extension Program in Egypt" outlines the mission of Extension, philosophical concepts of Extension and detailed job descriptions at all levels of operation. Both studies emphasize the necessity of subject matter specialists and the need for a closer working relationship with research.

- With the creation of the Agricultural Research and Extension Authority there would be established an Agricultural Extension Service headed by an Undersecretary, with a Director handling a number of important staff offices, including budget and finance, program planning, training, communications and extension methods and extension studies. Two additional Directors would be needed, one to head the Extension Technical Support Division and the other to head the Extension Field Execution Division.

- The Technical Support Division would consist of National Extension Program Leaders corresponding to the Research Institutes. Thus, the National Extension Program Leader for field crops would relate directly to the Director of the Field Crops Research Institute, have the same rank and equivalent responsibilities in total program development, both research and extension. Similarly other extension program leaders would be housed with and relate directly to the respective institute directors. This would insure program coordination and integration at the national level.

- National Extension Program Leaders would have a staff of subject matter specialists. Using Field Crops as an example, there would be an extension specialist for each of the major crops. These individuals would serve as members of the interdisciplinary research team, with the same rank and equivalent responsibilities as their

counterparts in research. In addition, they would be the education source for the field force in extension. Similar arrangements should be developed for the major field crops, horticultural crops and livestock.

- Subject matter extension specialists would also be organized on a similar basis at the regional level. They should be housed at the research station, have similar rank and responsibilities as the research scientists and serve as a member of the multidisciplinary research team. In addition, they would be the education arm for the field force. Whenever appropriate they could be housed with faculties of agriculture on university campuses.

- The second Extension Director would be responsible for all of the field extension personnel. There would be a Director at the governorate level who would be technically responsible to the Director of the National Extension Service and administratively responsible to the Governor. He would coordinate activities between the subject matter specialists and the field personnel. District Extension directors would have a similar role at the district level. Under them would be placed supervisors who would be responsible for the day-to-day activities of the village extension agents. The number of villages, size of villages and number of feddans on the farms being served would determine the number of supervisors and village agents. The District Extension Director would also be responsible for maintaining working relations with other institutions within the Ministry of Agriculture at the district level. The same would be true for the village worker. In cases where villages are too small to justify extension agents, multi-agents could be appointed. Detailed descriptions of all extension workers have been described in the "Implementation of a Strengthened Agricultural Extension Program in Egypt," April 1982.

- Joint appointments are to be encouraged wherever feasible whereby individuals could serve in a dual role of research and extension. This would especially be needed in the early implementation of the subject matter specialist concept in extension because of their absence under the ixisting organization. With the present well-trained staff in research this should pose no serious drain on their staff. Likewise, joint appointments beween faculties of agriculture employees and those at the Authority should be encouraged, depending upon the capability, availability and attitude.

- The General Authority for Agricultural Production should be transferred to the Agricultural Research and Extension Authority. Land needed for research should be assigned to the Agricultural Research Service and the remainder placed under an Undersecretary responsible for the development of foundation seed before being released to the General Department for Seed Production. Obviously there would need to be close working relationships between the crop breeders, the State Farms (Development of foundation seed) and the General Department for Seed Production.

- The AID projects, though highly successful, have been functioning essentially outside of the recognized subdivisions of the Ministries. In some cases steps have been taken to institutionalize them. These AID-funded projects should be integrated into on-going programs within the appropriate units of the Ministries as quickly as is feasible.

- Concern is expressed for the apparent duplication of functions between the AREA, the Academy of Scientific Research and Technology and the National Research Center (NRC). With the implementation of the AREA as recommended there would seemingly be no justification for many of the agricultural and rural development activities within the NRC or the Academy.

UNIVERSITY RESEARCH

For the research potential to be realized within the university faculty will require some major policy decisions in the country. Professors now have heavy teaching loads plus other duties that compete for their professional time. Budget adjustments need to be made to allow for research time as well as teaching time.

Research facilities are deplorably weak. Space, equipment, supplies, and library books and journals are necessary tools for research scientists and most of the universities do not have them in quantity or quality required. They also need a system for keeping laboratory equipment functional without waiting for months for repair parts to be ordered from overseas. The question here is not one of a few additional equipment items but major installations in most of the laboratories of most of the universities.

Formerly a significant number of promising young scientists were sent overseas for graduate degrees. Currently the universities seem to be developing their staff from their own students. In the long-run this inbreeding will be costly and lead to a lowering of the quality of the faculty. Ways should be explored, through donors or otherwise, to send a higher percentage to foreign universities, either as degree candidates or as post doctorates.

University professors now have little linkage with the ARC except through the graduate students. A broader participation in the planning and implementation of research would not only create more knowledge but would result in better teachers.

It is inconceivable that teachers can continue to perform at their potential especially in the training of graduate students, with no direct contact with research.

University professors are also isolated from the outside world. With few exceptions there is little association between the teaching faculty and the extension staff actually serving the producers. This could in many instances be a complementary relationship. The teachers would become closer to the problems of the region and the extension could profit from the association with other professional groups.

RECOMMENDATIONS

- Egypt needs to change its educational policy regarding the admission to university enrollment and the guaranteed employment of its graduates. The system lowers the quality of university training and floods the government with employees far beyond its capacity for utilizing them effectively.

- More support should be given to technical level training for the preparation of those entering government and industry. This could be accomplished by up-grading the agricultural secondary high schools or establishing 2-year technical institutes within some of the universities.

- The Minister of Agriculture should take the initiative in developing a national policy that would include universities with faculties of agriculture and home economics in the research and extension activities of the country, consistent with mutual interest. Their participation should begin at the Minister-Chancellor level in the development of broad policies of mutual interest. Funding would need to be provided by the Ministry and would be of two categories, namely, (1) grants made to universities on a competitive basis for specific studies and (2) support for collaborative research to involve the university in interdisciplinary research. The extent of participation by the universities would depend upon the availability of funds and the capability, availability and interest of the individual professor.

- The degree awarding programs at the universities should be reduced. Graduate degrees should be restricted to the major commodity departments, namely field crops, horticultural crops and livestock, and to the major disciplines, namely, soil science and water technology, botany and physiology, plant pathology, entomology, microbiology, genetics; to animal nutrition and physiology; and to agricultural economics and sociology, including training in extension methods. The undergraduate degree awarding programs should be limited to five: crop production, soil and water management, animal production, pest control, and agricultural economics.

- Undergraduate degree programs in home economics (with a strong base of agricultural study) should be expanded to two or three rural universities, in order to have a pool of rural-oriented professionals who can serve in extension and who will want to work in geographic regions outside of Cairo and Alexandria. No additional graduate programs are needed in home economics.

- Improving the climate for research, extension and teaching will necessitate more budgetary support for equipment, supplies, travel and libraries at the AREA and at the universities. Salaries are reportedly comparable at the Agricultural Research Center and the universities although there seems to be more opportunity for incentives at the latter. All salaries need to be increased and should be related to performance, not longevity.

- A higher percentage of the candidates for the Ph.D. degree should attend overseas universities. Post doctoral training at overseas universities is recommended for those being retained at the universities or at the AREA but who earned their Ph.D. degrees locally.

Staff Offices of the Minister

A number of functions and activities are of broad concern to the

ministry and transcend the responsibilities under the various First Undersecretaries. It is proposed that these be handled in 6 offices responsible to the Minister.

Statistics and Projects Office

Heretofore, collecting and publishing agricultural statistics has been a function of the Undersecretariat for Agricultural Economics. This is an important task but it is quite different from conducting economic analyses. It is a very large but relatively routine task which might be performed by a separate staff office. This office would also handle the routine job of assembling and classifying projects.

Procurement and Accounting Office

A Central Procurement Office usually is helpful in increasing efficiency in obtaining needed equipment and supplies from a personal, quality and time standpoint. This office also has the final accounting responsibility.

Personnel Management Office

The Personnel Management Office would be responsible not only for hiring, employment records, separations, etc., but also would be involved in training and manpower development, in cooperation with the various units of the Ministry.

Minister's Office Services

The functions of this unit will be essentially those now in the present Undersecretariat for the Minister's Office.

Foreign Agricultural Relations

The responsibilities of this office will be those now in the present

Undersecretariat for Foreign Relations.

Special Integrated Projects

There is a new organizational need of major proportions that does not show up on any present organization chart. It has to do with two problems involved in having several foreign donor aided "projects" operating in a country.

One of those problems is the confusion and duplication of having some pesonnel within such projects, and other personnel outside of the projects but in regular wholly domestic agricultural agencies, having identical or very similar tasks.

The other problem is how to absorb the activities of a project into on-going domestic agricultural programs when the foreign aid ceases.

Foreign aided activities usually are set up as autonomous projects at the insistance of donor agencies for three reasons:

--to concentrate adequate program resources on what are judged to be currently high priority problems or opportunities;

--to by-pass what are perceived to be the current weaknesses or constraints or regular agricultural agencies; and,

--to assure adequate coordination of all highly complementary activities that are important to reaching the projects's objectives.

Those three reasons suggest steps that might be taken to reduce or eliminate certain problems which foreign-aided projects raise.

One would be to recognize the advisability of marshalling the resources of regular agricultural agencies to concentrate, for a period of time, on a pressing current problem or a promising opportunity "in

project-like fashion" and make such campaigns an on-going feature of the program of regular domestic agricultural agencies.

A second would be, through appropriate in-service training, to augment the competence of personnel in the domestic agricultural agencies so that they would be fully competent to carry out their respective roles in integrated special projects or campaigns. In other words, instead of by-passing incompetence, remove it.

A third step would be for donor agencies to shift much of their aid from project grants and loans to program support, and work with the appropriate government officials to determine whether the support should be allocated to domestic agencies for single-agency programs or for integrated programs involving more than one agency.

Only the donor agencies can take this third step but their willingness to do so is bound to be considerably influenced by the extent to which the government of Egypt shows a readiness to take the initial two steps.

Egypt needs to continually upgrade the skills of all personnel in all agricultural agencies. It needs to adopt the practice of concentrating some of its resources on multi-agency campaigns related to urgent problems or opportunities. It needs to develop techniques for achieving coordination of highly complementary activities to make project-like campaigns successful. It needs these even in the absence of any foreign aid, but achieving them would make it easier to persuade donor agencies to shift from project grants to loans to general (sectoral) program support.

Experience with past cooperative development projects in Egypt, and in many developing nations throughout the world, has clearly demonstrated that the "institutionalizing" of such projects--and ensuring their on-going contribution to national development--is a critical problem. The

proposed Office for Special Integrated Projects would have the responsibility for addressing this issue and for working with donor agencies and developing corrective actions. This offoce would work closely with the national commodity research and development teams of AREA. It should have a budget that could be allocated as a supplement to operational units, when mecessary, to provide for full cooperation of all disciplines and needed technologies.

III. OVERALL AGRICULTURAL DEVELOPMENT STRATEGIES AND THEIR IMPLICATIONS

The establishment of a Deputy Prime Minister for Agriculture and Food Security would have a number of implications to Egypt and donor governments. It would enhance the visibility of agriculture and food security both in the Egyptian government and by the people as a whole. It would facilitate the ability of the government to plan, evaluate and carry out agricultural sector policies from a holistic standpoint. Each involved Ministry would become more knowledgeable of the problems and programs of the entire agricultural sector and how these ministries relate to the problems and to other ministries. It should make it easier for those ministries having responsibilities in the agricultural sector to speak with one voice on agriculture and food security in the council of ministers. It should result in a larger investment in the agriculture sector as related to other sectors, an action that is long overdue. Donor agencies should find it easier to obtain cooperation and coordination between and among ministries. It should result in donors being less concerned with specific projects and to concentrate more on overall program planning and coordination.

The establishment of an Inter-Ministerial Work Group between the Minister of Agriculture and the Minister of Irrigation should improve the cooperation between the two ministries on problems of mutual interest. It should reduce duplication of activities where this exists and should increase joint planning on current and new activities. It should be easier to solve some of the problems and disagreements that currently exist between the two ministries, some of which are long standing. Problems such as the water requirements of plants, timing and amounts of water to be delivered to farms, removal of drainage waters and maintenance of canals and drainage systems are just some of the items that have common interest to both agencies, where the actions of one ministry may affect actions or achievements of the other ministry. Joint planning and agreement on many such problems could have far reaching effects on

the conservation and effective use of the soil and water resources of Egypt.

Donor agencies should find it much simpler to obtain coordinatior and effective results if their objectives in matters relating to these two ministries are correlated.

Assistance to the farmers in raising and straightening the meskas and in providing for water control should probably be provided by the MOA. This will require both financial and technical assistance if its job is to be completed in any reasonable period of time. There is probably no investment in the irrigated agriculture sector that would provide more dividends totally and quickly than the improvement of the irrigation and drainage systems at the farmer level. The technical input could come from the Director Generals for Soil Management, Water Management and Land Amelioration. Assistance in construction, land leveling etc. could come from the Director General for Land Amelioration. Financial assistance could come from subsidies through the Director General for Land Amelioration or low interest loans from the Principal Bank for Development and Agricultural Credit or a combination of both.

The establishment of an Inter-Ministerial Work Group between the Ministry of Agriculture and the Ministry of Reconstruction and Land Reclamation should have the same general implications for these two Mininstries as indicated for the Inter-Ministerial Work Group for Agriculture and Irrigation.

The recommendation for the establishment of a research and demonstration farm on new areas to be developed for irrigation (lateral expansion) would assume the MOA had primary authority for determining and selecting the best land to be developed. Irrigation water would have to be made available by MLR to the research and demonstration farm site some five to ten years prior to full development of the area. MOA would provide the scientists, farm equipment, supplies, etc. to conduct

the needed research. Obviously, funds would have to be made available for these purposes, but this cost should be considered as part of the construction price of the development of the area.

The recommendations for restructuring the MOA should assure that the Ministry can focus on the essential functions and services of the Ministry in an effective and nonduplicatory manner. At the same time as many of the nonessential functions should be removed from the Ministry. The suggestions made are merely one example of how the Ministry could be restructured. If it is restructured along the suggested lines or some other manner which will accomplish the objectives of being able to focus on essential functions and services, it would greatly increase the efficiency of the Ministry and should result in better services to the farmers and in turn, greatly increase the productivity of Egypt's agricultural land. Potentials exist for increasing productivity up to 50 percent or more with present technology and over 100 percent with what appears to be new technology that should be relatively easy to develop. A restructuring of MOA would do much to assist in reaching these potentials.

Implementation of the recommendations creating an Agricultural Research and Extension Authority would have major implications upon policies of the government of Egypt, as well as donor governments. Placing restrictions upon enrollments of university students in the agricultural curriculum could not be achieved on a unilateral basis. Raising the requirements for graduation and no longer guaranteeing employment for all could be accomplished only in concert with broad governmental policies.

In the short run agricultural production should be increased primarily because of a more effective extension program and more relevant research. In the long run Egypt should realize more agricultural production, a healthier economy, and a better fed people, resulting from more relevant research, more efficiency in the use of scientific personnel and a more effective university curriculum.

Donor roles would also be affected. Expatriates would be needed immediately in working directly with the directors of research and extension in formalizing the new research and extension organization. Expatriate research scientists would be essential in implementing the multidisciplinary teams, especially in indoctrinating the philosophical concept. Short term consultants would be helpful in reviewing the adequacy of the research stations and the universities with respect to graduate training and collaboration in research and extension. The success of this concept would be dependent upon donor funds in the short run.

Future donor roles would place a greater emphasis on planning and development and less on specific projects. Major outside support would include funds for (1) research and extension programs; (2) overseas training for promising scientists; and (3) leadership roles in research and extension multidisciplinary teams.

EGYPT: STRATEGIES FOR ACCELERATING AGRICULTURAL DEVELOPMENT

ANNEX D

EGYPTIAN RURAL WOMEN AND THEIR ROLE IN AGRICULTURAL DEVELOPMENT

By

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ANNEX D: EGYPTIAN RURAL WOMEN AND THEIR ROLE IN AGRICULTURAL DEVELOPMENT

Agricultural development is a goal of the Egyptian government. Included in most discussions of development are economic and social concerns, with attention to rural poverty and to altering the imbalance of development in the capital compared to other regions of the country.

Women play a key role in the economic and social concerns related to Egyptian villagers. Rural Egyptian women are important in human capital development because of their role in children's education and in the maintenance of physical and social well-being of the family; they also are important in agricultural development because of their direct and indirect involvement in agricultural production, processing, marketing and consumption.

This paper considers the expansion and/or potential for increasing the effectiveness of women's roles as part of the basic concern of the mission: that of strategies for accelerating agricultural development.

General recommendations for increasing the human capital investment in Egypt, with particular emphasis on contributions of women to the human resource base for agriculture are summarized here. Each of these recommendations must be further refined through consultation with both professional and village Egyptian women as well as Ministry of Agriculture officials to determine relative priorities and to identify most appropriate processes for implementation. The general recommendations follow:

1. Increase and improve educational programs for rural women through the National Agricultural Extension Service.
2. Increase the research base to better design and serve extension programs and to assist in policy-making.

3. Improve education for professionals working with programs to benefit rural women and children.

4. Increase the extent of rural household and agricultural technology.

Two additional general recommendations relate to agricultural and rural development:

5. Increase opportunities for women's income generation, including access to credit.

6. Increase employment opportunities for women in rural industries.

The bases for these general recommendations, along with some specific recommendations are presented in relation to human capital development, household production, and agricultural production.

HUMAN CAPITAL DEVELOPMENT

Schultz suggest that the most important factors in "improving the welfare of poor people are not space, energy, and cropland" but rather are improvements in "population quality" and knowledge advancement. Population quality can improve with good child care, directed and educational home and work experiences, "acquisition of information and skills through schooling," and improvement in health care (Schultz:7).

> Human capital development contributes to labor productivity and to entrepreneurial ability valuable in farm and nonfarm production, in household production, in the time and other resources that students allocate to their education, and in migration to better job opportunities and better locations in which to live (Schultz: 11-12).

Women contribute greatly to human capital development, particularly through their involvement in children's education. The entire family may bear the cost of foregone children's earnings, but the adjustment in household and field work is likely to be made by women. Further, a child's environment affects his cognitive development, and the mother is a major part of this environment.

Investment in children as human capital is provided through care by parents, public health programs and early schooling, according to Schultz (p. 27). One indirect measure of human capital development is the survival rate of children. Infant mortality is estimated to be 116 per thousand live births in Egypt (Ikram:107). Another indicator is preprimary and primary school enrollment. Enrollment rates for Egyptian children aged 6-11 increased from 46 percent in 1952-53 to 74 percent in 1965-66, then declined to 70 percent in 1975-76 (Ikram:118).

Increases in women's literacy and formal education for females increase cognitive skills which in turn influence children's cognitive development. The importance of cognitive and technical skill development in relation to adoption of new agricultural policies and production technologies, as well as in managing and living in a modern economy, has been described in "Strategies for Accelerating Agricultural Development."[1/]

Improvements in health of the rural population can help increase productivity of the working population. In comparing high and low malarial incidence districts in India, considerable support was found for the proposition that malaria control increases agricultural output (Ram and Schultz:420). In Kenya, low weight for height among road workers was found consistently and significantly to relate to low productivity (Brooks et al.).

The relation of work capacity to marginal malnutrition is not clear, especially when one considers that work performance and work efficiency are not necessarily related to work capacity.

> ...the nutrition-work interrelationship is only part of the overall nutrition-health-well being of the individual and his/her society. It may very well be the case that increased food availability for the working force can result in significant and desirable changes in out-of-work behavior, sometimes more meaningful in terms of development and well-being than simply greater work output (Viteri et al.:281).

[1/] Strategies for Accelerating Agricultural Development, A Report of the Presidential Mission on Agricultural Development to Egypt, 1982. To be referred to as SAAD.

Two of the most pressing health improvement needs in Egypt are to reduce and eventually eliminate the incidence of bilharzia with its consequent nutritional impact and to reduce undernutrition especially among young children.

The nutritional status of women and children in Egypt is of particular concern in considering investment in human capital. Mothers who are weakened by early and closely spaced pregnancies have reduced capacities to give good prenatal and infant care (RAPID:35).

Children up to 24 months of age in Abis, Egypt, were studied through their health records and interviews with their mothers. Several factors significantly affected the child's growth, hemoglobin and nervous system maturation: (1) the mother's age, height, body weight, hemoglobin level; (2) the intervals between births and/or pregnancies before and after the birth of the child studied; (3) socio-economic factors--number of children environmental sanitation, and family income. Growth, hemoglobin, and nervous system maturation all declined after the children reached 6 months of age (Isis).

From a survey of Egyptian children 6 months to 6 years of age conducted in 1978, chronic undernutrition was found in one-fifth of the children (National Nutritional Survey:79).

> In growing children, particularly preschoolers, ingestion of nutrients at levels under needed requirements will affect metabolic processes and produce a biologically weak individual. A marginally malnourished child has less defenses against infections, frequent pathology, less physical vigor and reduced work endurance. Low vitality induces apathy and lack of interest in the surrounding environment. And, lack of work endurance produces lower productivity (Sinisterra:268).

The functional significance of less-than-severe malnutrition is not well established, and populations appear to adapt to undernutrition (Am. J. Clinical Nutrition:875).

The impact of recently instituted supplies of bread and flour in rural areas at subsidized prices is unknown. The possibility of future alteration in the subsidization policy brings the question of whether or not social adaptations of protective patterns of food sharing and food selection will be re-established (Am. J. Clinical Nutrition:879).

HOUSEHOLD PRODUCTION

Women are responsible for household production in Egypt. Mothers receive assistance from daughters, but men have little involvement in household activities related to food preparation, house-cleaning, care of clothing, and care of children and the elderly.

Many aspects of household production serve to create a heavy burden for women: (1) it is typically added to women's substantial agricultural production responsibilities, (2) the major responsibility is placed on young women (daughters-in-law) who are in child-bearing and child-rearing years, and (3) very few or no technologies are readily available to aid in the collection and storage of water, collection and carrying of fuel, washing clothes, and the like.

Nelson suggested from her work in a Basaisa experiment that need exists for "labor saving devices that decrease the time and effort women have to spend on non-productive energy-consuming tasks such as fetching water, washing by the irrigation canal, using milk machines in other villages, having to shop for basic commodities in other villages" (Nelson:11).

In an annex to "Increasing Agricultural Production Through More Effective Use of Technology," the suggestion was made that the household technological improvement with the highest payoff is probably providing a water tap inside the house (Firebaugh). Rather limited data are available about alternate uses of time, although a study in Kenya found that with the availability of safe nearby water, the time saved in fetching water and in washing was used in farming (Whiting and Krystall, 1979).

According to the Egyptian Ministry of Housing, General Organization for Potable Water, fewer than 5 percent of the rural households have access to an individual water supply connection. Further,

> in the rural areas the most common form of internal water supply facility seen was a single tap feeding one basin, often without any form of piped drainage. With this arrangement all waste water must be lifted out of the basin and physically carried out of the house for disposal in the street or elsewhere (Provincial Water Supplies Project, 2.5.16 and Table 2.5.1).

AGRICULTURAL DEVELOPMENT

The interrelationship of country policies, labor and wage rates and their impact on women has been described by Tadesse who noted that women have been integrated in planning as

> reproducers of labour power, producers of subsistence foodstuffs for family consumption, and very often as unrenumerated familial labour in cash crop production or as cheap seasonal labour in large plantations. Women are important constituents of the labour reserve for capital on the one hand and the use of female wage labour is closely related to the maintenance of low wages on the other (Tadesse:79).

Women's involvement in agriculture is through unpaid family work, agricultural labor, and income generating activities related to agriculture. Statistics for men and women are weak, but women's role in unpaid family work is generally thought to be under-reported. The definition of unpaid family work is in non-domestic activities for at least one-third of the normal hours of employment (1954 ILO Resolution). Women's unpaid family work is often integrated with household work and the line between the two can be very fine, resulting in an underestimation of women's non-domestic work. Beneria proposed that active labor "should include all workers engaged in use value as well as exchange value production which includes activities such as household production and all types of subsistence production: (Beneria:25).

The current Egyptian labor shortage at peak seasons of agricultural production is partially met by women and children. Women and children

earn less than men and are an important part of the labor pool. Women often work seasonally, while more men are permanent wage laborers. If the wages paid to Egyptian agricultural labor were more in balance with wages paid to other sectors, the less expensive female laborers may well be more often employed in agricultural jobs.

The Food and Agriculture Organization (FAO) supported a study which described the female agricultural participation in rural areas of Upper and Lower Egypt as follows:

	Percent Female Participation	
Activity	Lower Egypt	Upper Egypt
Plowing	49.7	10.9
Harrowing	49.7	41.3
Drilling	54.5	41.3
Cultivation	62.9	33.7
Irrigation	62.3	34.8
Fertilizing	56.9	38.0
Resowing	64.1	34.8
Thinning	65.8	34.8
Hoeing	55.7	37.0
Insecticide spraying	55.7	38.0
Reaping	67.7	38.0
Transporting crops	70.1	27.2
Packing crops	65.3	41.3
Animal husbandry	20.3	28.4
Curing animals	24.6	10.5
Milking	73.2	55.2
Raising poultry	79.0	81.5
Home agricultural manufacturing	64.1	45.65
	n = 67	n = 92

Some long-time observers in Lower Egypt question the findings related to insecticide spraying, plowing and harrowing. They suggest that these tasks are carried out by men. Zimmerman notes that in a Kafr al Bahr

study that women participate in almost all agricultural activities except plowing. Whatever biases are in the data, female participation in agricultural activities appears to be quite high.

Of special note is the high female participation in poultry-raising and milking. Zimmerman reports that milking and selling of dairy products was done exclusively by women, while care of cattle was primarily, but not exclusively a responsibility of women.

> Cattle raising and dairy products are especially popular among farm women because of the cash income derived from the trade in dairy products...The income from trade is spent by the women as they see fit; usually on the necessaries of life such as food and clothing for the family. They may also, however, save money for varying purposes such as education for the children, payment of rent, religious meetings (Zimmerman:19).

RECOMMENDATIONS AND BACKGROUND FOR IMPLEMENTATION

1. Increase and improve educational programs for rural women through the National Agricultural Extension Service.

   - Extension programs in agricultural practices, managerial and income-generating skills for women should be developed and strengthened. Priorities for developing and strengthening programs should reflect a systematic assessment of specific program needs. Since women are heavily involved but under-trained in agriculture, they should receive high priority in terms of program development (SAAD).

   - Extension programs should be increased and strengthened in the areas of household management, household living conditions, health and nutrition practices, family size decisions, and education of youth. These programs should be taught by and directed toward women, with the aim of increasing their household and agricultural productivity (SAAD).

Organization. Within the recommended Technical Support Division for the National Agricultural Extension Service, an Extension Program Leader for "Programs for Rural Women" would give direction to the development of

a strong extension program.

Related subject matter specialists are also recommended within the Technical Support Division. Subject matter specialists previously noted as needed were in foods and nutrition, including maternal and child nutrition and food preservation; resource management, including decisions on family size, housing, storage, sanitation; income generation and marketing through agriculturally related activities (e.g. poultry production, dairying, beekeeping); and household production (e.g. sewing, food production) and youth development (Firebaugh).

Village level programs. An earlier recommendation also proposed that local leaders be trained to disseminate information on improving agricultural production and living conditions at the village level (SAAD). The rationale for this recommendation is the apparent reluctance of professional women to live in villages. Additional merits of the recommendation are the increased opportunity for growth and prestige for local women with leadership ability and increased likelihood that information will be accepted and utilized at the local level.

Local leaders and institutions have been used in rural Egypt with considerable success in an integrated rural development program conducted in Shanawan (Gadalla).

SPECIFIC RECOMMENDATION:

- Pilot extension programs should be developed in a limited number of governorates to test appropriate methods for strengthening village-level extension work. With assistance from an interdisciplinary team, support could be sought from village leaders to implement extension programs determined to by high priority in the village.

  Possible alternate methods are:

  --Women extension agents train wives of village leaders or other paraprofessionals to teach other village women (see Esman et al.).

--Women extension agents work with vocational/technical women graduates to teach other village women.

--Women extension agents be given adequate support and incentives to live and work in villages directly with village women.

It is proposed that a donor-supported project assist with the design and implementation of a delivery system within the agricultural extension for a program for rural women. Parallels to this proposal are USAID projects in Major Cereals, Mechanization etc. The concentrated attention to the commodities and associated problems has given new direction and new commitment to linking research with extension and seeking solutions to continuing problems. Such an approach to problems and programs for rural women could likewise result in new vision, commitment and accomplishments.

2. Increase the research base to better design and serve extension programs and to assist in policy-making regarding programs to benefit rural women and families.

A recommendation that a Research Institute for Rural Women and Development be established within the proposed Agricultural Research and Extension Authority (AREA) has been made (SAAD). The institute would be charged with providing a research base for strong extension programs directed toward the roles of women and their relation to increased productivity in agriculture and improved quality of rural life.

University research programs related to rural women are primarily dissertation- and thesis-based and the results do not currently reach the extension program. Meaningful action research addressed to help solve problems of rural women and families, and expanded extension efforts to disseminate findings must have personnel oriented to the concerns of rural women.

Survey technology as well as other research techniques in the U.S. are highly developed; many are transferable to the Egyptian setting.

Research personnel need increased capabilities and support to initiate and sustain a strong research program.

SPECIFIC RECOMMENDATION:

- Collaborative work with U.S. universities and an upgrading of research skills and facilities are needed to achieve the desired quality of research in both AREA and universities.

- Research activity should closely parallel high priority extension areas of emphasis. Research needs include investigating the impact of agricultural technology on men, women and children; household food and energy consumption; nutritional status and energy requirements of all family members for activities in the Egyptian climate; design and evaluation of nutrition education; decision-making patterns of family members; sources of family income; analysis of income-generating activities; costs and benefits of income-generating projects; specific roles of women in the household in relation to the educational aspirations of girls; impact of remittances on family financial management; effects of rural-urban migration patterns on remaining village family members; relationships between agricultural and household production. Frameworks and analytical methods from the "new home economics" as well as some from "traditional" home economics can supply direction for the design and implementation of the research.

- To improve an information base for evaluating policy changes, a system for periodic data collection and analysis should be developed in order to follow the effects of policy changes on the labor force and household members not in the labor force.

SPECIFIC RECOMMENDATION:

- That a project be designed and implemented to describe and analyze by sex and age agricultural labor force participation, unpaid family

work, and household production. Cooperation with the Central Agency for Public Mobilization and Statistics seems advantageous. The baseline studies on women in rural households as designed by FAO provide a good background for this effort (FAO).

3. Improve education for professionals working with programs to benefit rural women and children.

Helwan University offers undergraduate, Master's and Ph.D. programs in home economics. Alexandria University and Cairo University both offer programs focusing on rural home economics within the College of Agriculture.

Existing university programs in home economics should be strengthened in high priority areas for meeting the needs of rural women and families. Such areas as foods and nutrition, family economics/family resource management (including energy resources, income-generating skill development and analysis), and family environment (including sanitation of farm and home) and animal care should be addressed (SAAD).

It is essential that professionals who work with rural extension programs have an orientation to the concerns of rural Egypt and have experience in rural areas. It has been previously noted that professional women are often reluctant to live in villages. Programs of study should contain basic agriculture, as does the curriculum at Cairo University, as well as priority areas of home economics.

Specific linkages with U.S. universities could assist with the strengthening of current programs and development of additional programs. The critical issue is the focus on subject matter within home economics which is related to development. Home Economics programs in developing countries have often been criticized for their serving to improve the marriage opportunities for middle-class girls. Preparation of professionals with a background and an orientation toward work with rural women and development is a need which must be carefully examined and considered.

SPECIFIC RECOMMENDATIONS:

- University programs in rural home economics with a strong agricultural base of study should be developed in one or two rural universities in order to create a pool of rural oriented professionals who can serve in extension. Linkages with U.S. universities should be initiated to assist with the strengthening of current programs in home economics and to develop additional programs.

4. Increase the extent of household and agricultural technology.

A shortage of technologies exists for reducing the physical energy required to meet family needs. Increasing the availability of electricity in rural households (19% in 1976) and water inside the household unit (5%) is basic to acquisition and use of many technologies. Even without electricity and water, equipment has already been designed which can assist in easing household productive activities. "Many of these (technologies) offer the chance of increasing the productivity of the women's labour without requiring large financial outlays, important mateirals or high skilled labour for operating, maintaining and repairing equipment" (Carr: 194).

SPECIFIC RECOMMENDATION:

- Extension should pursue the identification of high priority technological needs for the household and design programs for the acquisition, use and maintenance of these technologies.

- The necessity of increased technological advances for agricultural development has been described in the team report (SAAD). Studies in countries with wide usage of high yielding varieties of cereals, such as rice in the Philippines and wheat in the Punjab area of India, have found that women's responsibilities are altered considerably. Women are called upon for increased work in planting and harvesting when high-yielding varieties are used. Tadesse and others suggest

that increased agricultural technology generally results in increasing or negatively altering women's work (Tadesse:105).

SPECIFIC RECOMMENDATION:

- Research on the effects of agricultural technological changes on women and children should be instituted in order to provide information to policy-makers for evaluating other proposed changes.

5. Increase opportunities for women's income generation, including access to credit.

The recommendation that the Principal Bank for Development and Agricultural Credit increase medium- and long-term loans and that they liberalize loan policies to meet the credit needs of various groups, including women in income generating enterprises is important. Increased opportunities for income generation will depend partly on access to credit. Credit may be needed to acquire cattle, purchase equipment for handling milk, secure facilities for enlarging poultry operations, or to acquire the basic inputs for other production.

Increased skills in income generation are also needed, and a strengthened extension program for rural women should help develop specific skills and general managerial and analytical skills. An outgrowth from involvement in income generation is likely to be an increased interest in formal education.

Along with income-generation projects should go a commitment to research the costs and benefits of these projects. It appears that with donor inputs, households are not clear on the costs of the project and thus may have difficulty in later analyses of product costs.

SPECIFIC RECOMMENDATION:

- Constraints to increased opportunities for women's income generation must be identified, and programs should be designed to help overcome

these barriers

6. Increase employment opportunities for women in rural industries.

Although the major thrust of this paper has been toward agricultural aspects of rural Egypt, a strong case can be made for increasing the opportunities for off-farm employment, particularly of women. Associated with off-farm employment is a reduced fertility rate (Youseff:57) and increased earnings which allow increased asset accumulation for the household. Industries associated with agricultural products, which have sections of women workers only, can provide culturally acceptable work settings. Large poultry operations in rural areas now employ women. Access to credit would clearly be critical to developing rural industries. Formation of women's cooperatives could give rise to increased rural industries.

SPECIFIC RECOMMENDATION:

- The development of rural industries which could employ women should be examined and pilot projects should be initiated with specific plans to evaluate the results and effects on households.

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EGYPT: STRATEGIES FOR ACCELERATING AGRICULTURAL DEVELOPMENT

ANNEX E

MAJOR AGRICULTURAL INPUTS

By

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Grateful appreciation is expressed for information and comments provided by Egyptian counterparts in the Ministry of Agriculture, AID staff, and American and Egyptian staff members in the AID Small Farmer Production and Agricultural Mechanization Projects.

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ANNEX E: MAJOR AGRICULTURAL INPUTS

The purpose of this report is to briefly review and assess the status of the major agricultural inputs affecting crop production in Egypt. The inputs considered include the availability of agricultural credit, the costs and availability of hired agricultural labor, the progress of mechanization, and the supply of agricultural chemicals.

Since Egypt has almost exclusively an irrigated agriculture, water supplies are a major crop production input. However, it was decided that irrigation water supplies would more appropriately be assessed within the context of soil and water management in another report.

Similarly, improved seed production is considered in the assessment of crop production. The assessment of livestock and poultry production considers the supply of breeding stock, the availability of feed supplies and the adequacy of veterinary services.

II. THE AGRICULTURAL CREDIT-AND-INPUT DELIVERY SYSTEM[1]

The Principal Bank for Development and Agricultural Credit (PBDAC) provides agricultural banking and supply services in 17 governorates in Egypt; it serves all areas presently suitable for agriculture. The PBDAC system is the only source of institutional agricultural credit available to small farmers providing in-kind and cash loans. The Bank is also the principal supplier of basic crop inputs such as fertilizer, seeds, pesticides, jute bags, etc. Crop inputs are sold on a commercial basis as is livestock feed. Controlled crops are purchased and stored by the Bank. It markets and supplies spare parts for pest control equipment. Some governorate and village banks stock machinery and household items which are sold to village and farm residents.

The farm supply activity has been a large part of the total business of the PBDAC system since 1976. Although ostensibly a credit and financial institution, the volume of the supply and controlled crop purchase functions rival that of the banking activities.

Production inputs are subsidized both in terms of input prices and interest rates. PBDAC borrows loan funds at commercial rates and loans at somewhat lower rates. The government refunds the difference to the PBDAC.

The PBDAC is also charged with the responsibility for promoting village industries and has slowly been moving into that area of activity. Much more could be accomplished by providing credit service to farm-related businesses, particularly in assisting small businesses in villages to provide or improve needed services to small farmers. Examples are custom machine operators, parts and repair shops, and small equipment dealers.

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[1] This section draws on the Beginning of Project Report, Small Farmer Production Project, AID, March 1981. Additional helpful comments were received from Ron Gollehon and his project staff and John Foster, AID.

A. BANK STRUCTURE

The PBDAC is owned by the government of Egypt. It receives its policy direction from various ministries of the government; at present, however, it is directly responsible to the Minister of Agriculture.

The Bank is managed by a Board of Directors composed of the Chairman; two Vice-Chairmen; Undersecretaries of State for Agriculture; Finance, Economy and Economic Cooperation; Supply and Trade; Local Government and Planning; a representative of the Central Bank; a Councilor of the State Council; Chairman of the Board of the Central Agricultural Cooperative Union; three persons working in the field of agriculture appointed by the Minister of Agriculture; and eight Chairmen of Governorate Banks, four from Upper Egypt and four from Lower Egypt.

The PBDAC and its system is a large and complex organization. The Principal Bank is located in Cairo and has three branches located at Alexandria, Port Said/Cairo, and New Valley. The Port Said/Cairo branch has two office locations which are under one management.

The Alexandria and Port Said branch offices assist in facilitating the movement of merchandise through the ports. The New Valley branch is located in the New Valley Governorate where it supervises Bank activities carried out by 13 village banks and 65 agencies which are located in the New Valley oasis.

B. SERVICE OUTLETS

The principal outlet for the services of the PBDAC include 17 Governorate Banks for Development and Agricultural Credit (BDAC) which cover the Nile Valley and Delta areas. Under the supervision of the Governorate Banks are 138 district banks, which in turn supervise the operations of 735 village banks. There are 4,179 agencies under the direction of the village banks. These agencies act as distribution points for agricultural inputs issued to farmers; in some cases they provide

cash loans. The PBDAC has about 3,000 employees and the entire system, more than 30,000.

In the years since the reorganization of the agricultural credit system under Law No. 117 of 1976, the Principal Bank has made remarkable progress in several areas of activity. One of the most significant accomplishments has been the elimination of the large loan delinquency and loss carryover of LE 57 million which were assumed from the cooperative bank system at the time of the reorganization.

The PBDAC is now in the position of being able to utilize profits to build reserves, to improve its ratio between net worth and liabilities and to improve facilities.

The Bank system has been moving into more commercial banking activity and at the same time mobilizing saving in rural areas. The program for promoting current accounts, time deposits and savings accounts has shown the following pattern:

	Amount	Customers
1977	LE 43,579,358	N.A.
1978	58,611,945	119,531
1979	111,717,196	266,041
1980	152,622,154	373,904
1981	241,697,765	482,536

The increase in deposits and savings accounts has provided a major source of loan funds for banking activities and has significantly reduced the borrowing requirements from the Central Bank and commercial sources. This program has proven to be a valuable service to the rural community as well as an enhancement to the self-sufficiency and profitability of the banks.

At this time sufficient funds appear to be available to meet the short-, medium- and long-term credit needs of farmer borrowers, so long

as the bank retains its present very conservative lending policies. Loans for farm equipment for example now require 5 feddans security for tractors and 3 feddans for water pumps. These policies limit the ability of small farmers and tenants to obtain medium and longer term credit.

The loan repayment record for farmers who borrow from the village banks, mostly for in-kind production loans, has improved steadily since 1976. Loans paid, as originally agreed, improved from 79 percent in 1976 to 93.4 percent in 1980.

The aggregate volume of loans outstanding to farmers at year end increased from LE 83 million in 1977 to LE 200 million in 1980. There is a turn-over of loan funds of about twice in a calendar year which is a reflection of the low percentage of medium-term loans and the little long-term lending activity.

There is a recognized shortage of office equipment, storage facilities and management training. Progress has been limited by the financial position of the PBDAC and BDACs, which have of necessity put primary emphasis on overcoming the deficit position inherited in 1976. The system is now emerging as a strong organization that has overcome severe financial adversity. It is in a strong position to move to undertake the aggressive credit programs needed to realize Egypt's agricultural production potentials.

III. AGRICULTURAL LABOR: POLICY IMPLICATIONS[1]

There has been much recent discussion in Egypt about the rising costs and occasional shortages of hired agricultural labor. The issues of labor availability are important because they are basic considerations in the selection of appropriate strategies for mechanization, cropping patterns and improvements in the general welfare of rural people.

Wages for hired agricultural labor have risen at an accelerating rate in both nominal and real terms since 1973. Shortages of male adult labor have been reported in various parts of the country particularly in the peak labor periods of May-July and September-November. In 1981 labor shortages are reported to have delayed transplanting of rice seedlings and harvesting of cotton.

The phenomena of rising wage rates and spot seasonal shortages of farm labor in an economy characterized by high birth rates and traditionally by disguised employment and underemployment are not fully understood or explained in the available literature and data sources. Nevertheless, the matter is of growing significance to Egyptian farmers and policy makers. This section summarized available information and insight and explores policy implications.

A. WAGE RATE CHANGES

The rate of growth in wag s for hired agricultural labor since 1973 is unprecedented in the 40-year period for which data are available. Daily wage rates averaged about 25 piasters in the period 1966-1971. By 1973 the rate had risen to 28.5 piasters. In 1980 the national average daily wage of an adult male laborer was 137 piasters--a nearly four-fold increase in nominal wages in seven years. The increase in wages was nearly 30 percent in 1979/1980 alone. Seasonally, 1980 wages ranged from a low of 113 piasters in January to a high of 150 piasters in June.

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[1] Dr. Kenneth R. Farrell, SAAD consultant, made a major input into this section.

In real terms wage-rate increases have also been impressive. In the five years 1973-1978 wages increased 12-14 percent annually in real terms compared to real increases of 7-10 percent in preceding periods of high growth. From 1973-1978 average annual real wages earned in agriculture rose at a rate of 12 percent, compared to 9 percent in construction, 6 percent in services, and 3 percent in industry. In 1960, agricultural workers earned only one-fifth as much as workers in other sectors; in 1978 they were earning almost one-third as much. Thus, the real economic return to farm laborers has improved significantly relative to laborers in other sectors. Other evidence of a tighter supply of agricultural labor are shorter work days and fringe benefits, such as lunches, tea and cigarettes now being offered to farm laborers.

B. FACTORS AFFECTING FARM WAGE RATES

Analyses to date of supply/demand conditions in Egyptian agricultural labor markets are inconclusive in explaining empirically the rapid increase in wage rates of recent years. However, the consensus of analysts appears to be that recent increases are due not to increases in demand for hired labor in the agricultural sector but principally to supply constraints due to migration of agricultural laborers (Third Economics Policy Workshop, Migration and Mechanization in Egyptian Agriculture, Cairo, December 15-16, 1981).

On the supply side, analysts point to four major factors which have acted concurrently to reduce supply: military service, migration from rural areas, increased enrollment in schools, and increased farm fragmentation. the Census of Population indicates that 400,000 men from rural areas were in the military in 1976. More current data are not available but observers believe the number has not declined since 1976. The primary factors influencing agricultural labor migration has been the rapid growth in demand for construction labor brought about by a rural construction boom coupled with the migration of Egyptian workers to construction jobs

abroad.[1] Egyptian construction workers abroad were estimated at 200-250 thousand in 1976. Other estimates are as high as 600,000. Fitch et al. suggest that the first to migrate to the cities and abroad for work are the landless laborers followed by small landholders; both groups are expected to be agricultural wage laborers. Further, the majority of laborers migrating from rural areas leave their families behind in rural villages--a circumstance which may reduce participation in the labor force on the part of those who stay behind since remittances from migrants reduce the necessity of families to work.

Compulsory schooling has reduced the number of children in the agricultural labor force as well as affecting age distribution of the work force. Land reform and continuing fragmentation of land holdings has tended to shift labor from contract labor groups (typically landless laborers) with high mobility to workers looking for occasional work to supplement income from other sources including income from farming.

On the demand side of the market several factors have been operative. Mechanization, which is not insubstantial, has tended to decrease labor demand, although some believe that mechanization to date has been more animal-saving than labor-saving. On the other hand, changes in cropping patterns to favor fruits and vegetables and fragmentation of land holdings into smaller and smaller units with each including a fairly labor-intensive livestock operation have tended to increase total demand for labor in the farm sector.

Fragmentation of farm ownership can be expected to continue. However, there is some indication that the size of operational units, owned and rented land, is not declining at the same rate. In fact, operational units may be increasing in size in some areas. The available data are not sufficient to determine whether this is widespread. More research is needed on this question.

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[1] Fitch, Aly and Mostafa, Recent Trends in Agricultural Labor and Wages in Egypt: Implications for Agricultural Policy, 1980. Project paper of the Egyptian Farm Management Survey Project.

C. POLICY IMPLICATIONS

Although measurement of supply/demand variables affecting agricultural labor markets is imprecise, the fragmentary evidence available points to a significant reduction in the supply of workers available for hire, despite the fact that the total supply of labor in agriculture continues to be very large with significant underemployment existing side-by-side with hired labor shortages and sharply rising nominal and real wage rates for hired labor.

No immediate relief in rising wage rates is in sight. The "construction boom" in Egypt continues at a high rate; overall economic growth and consequent demand for labor in service industries is relatively high; demand for Egyptian workers in other Arab-speaking countries, although possibly softening as a result of the slowdown in petroleum markets, is still strong; in addition, size of the military forces is likely to hold at or near present levels. On the other hand, the Egyptian birthrate continues at close to 3 percent with a large number of people already available to enter the labor markets.

It is very important that the characteristics of rural labor markets be identified more accurately than at present as a basis of taking appropriate policy actions. If the current tightening of labor markets is a permanent phase of the development process in which labor is transferred from agriculture to other sectors then a policy to induce gradual substitution of capital for labor would be appropriate. On the other hand, if the factors forcing a contraction of hired agricultural labor supply is temporary or will be offset by additional entrants to labor markets from the very high birthrate in rural areas, a policy of mechanization, which is labor displacing, could generate unemployment and increase the underemployment already existing.

At this time the evidence is far from clear but suggestive that a "go-slow" policy of inducing selective mechanization and adoption of technologies without large labor-displacing effects would be appropriate.

Finally, it is important that Egyptian economic planners take into account the secondary or indirect effects of national economic policies upon the agricultural sector, including their effects on the supply and demand of farm labor.

Therefore, our conclusion is that Egypt needs more agricultural mechanization in order to meets its agricultural potentials. However, we believe that a "go-slow" strategy with respect to the encouragement of labor-saving mechanization is appropriate.

The Ministry of Agriculture should undertake continuing research on the current and future availability of agricultural labor. These studies will assure that policies regarding the encouragement of labor-saving mechanization are determined with a full understanding of the social impacts involved.

IV. MECHANIZATION AND SUPPORTING SERVICES[1]

Mechanization of Egyptian agriculture is substantially underway. The data on the amounts, capacity and condition of various types of farm equipment are subject to controversy, but reports indicate that a substantial proportion of plowing is now being done by tractor and increasing use of mechanical irrigation pumps is evident in the countryside. As indicated in the previous section, the costs of labor have rapidly escalated since 1973, though the continuation of the phenomenon is subject to considerable uncertainty. The significant policy issue with respect to mechanization is the role of the Egyptian government in encouraging or discouraging the continuation of labor-saving mechanization. Continued mechanization such as mechanical pumps or precision seeders, that has relatively little effect on labor requirements is needed to realize increased crop production.

Present government policies substantially encourage mechanization. Diesel fuel is marketed at considerably lower than international prices. Village banks provide equipment loans to landowners at below commercial rates. Imports by the PBDAC are obtained at favorable foreign exchange rates and are exempted from import duties.

These policies have had the most significant impact on the rapid increase in the use of tractors, often working on a custom basis. Four-wheel tractors are preferred because they can perform services such as operating threshers or pumps and can transport farm inputs and production.

The increasing use of irrigation pumps is replacing animals used to drive the sakia pumps. Release of cows and buffaloes during the feed-scarce summer season leads to some increase in meat and milk production and improvement in conception rates.

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[1] Dr. David Geiser and staff, Agricultural Mechanization Project were very helpful providing information for this section.

Mechanical pumps also lead to improvement in on-farm water management. Increased pumping rates permit more rapid irrigation coverage; this in turn reduces deep percolation which can lead to overloading of drainage systems, waterlogging of crop root zones and salinity problems.

In some areas, there are serious problems in the availability of surface water when needed, as for example, the last farmer on a poorly maintained lateral (meska). Where conditions are suitable, a mechanical pump offers the potential for an alternative water supply from a shallow well. Mechanical pumps may be individually owned, custom-leased or jointly owned within an expanded sakia farmer group, the traditional unit of farmer cooperation.

A serious constraint on mechanization is the current lending policies of the village banks. Loans must now be secured by relatively large land collateral, e.g., 5 feddans for a tractor and 3 feddans for a mechanical pump.

There are serious problems regarding maintenance and available repair and service. A major problem is the neglect of preventive maintenance by equipment owners. Available repair services are improving but village repair shops are typically small and poorly equipped. Proprietors are often illiterate or lack appropriate repair manuals in Arabic.

Finally, the need to continue expanding research and development regarding appropriate equipment for Egyptian farming conditions is important. Given the uncertainty with respect to the continuation of the present farm-labor shortage, primary emphasis should be given to improved equipment for fertilizer and seed placement, land-leveling, threshing and village or farm crop driers to reduce harvest times and thus intensify crop rotations, e.g., for beans and wheat.

V. AGRICULTURAL CHEMICALS

Egyptian farmers are supplied with fertilizers and pesticides through the PBDAC bank system. No farmer in Egypt is more than a few kilometers from a distribution point.

The village bank allocates fertilizers and pesticides at subsidized prices in accordance with recommendations set forth by the technical committees of the Ministry of Agriculture and depending on the availability of chemicals. These quotas, provided typically as in-kind production loans, often have not been in the quantity or type of materials satisfactory to the farmer, and a free market in agricultural chemicals has flourished. Recently, allocations of fertilizers have been increased and availability now appears to be less of a problem.

Assuming that fertilizer supplies remain adequate, major supply problems will be limited to the handling, storage and scheduled delivery of supplies. Improved storage facilities in the PBDAC system are needed. It is estimated that handling losses amount to 5 percent of deliveries. Plastic sacking material is deteriorated by open storage. Fertilizers in broken sacks suffer deterioration of quality as well as quantity, and the farmer is required to take what is available as part of his in-kind loan.

Fertilizers are typically broadcast by hand which leads to volatilization of ammonia nitrogen. This problem requires research and development with respect to approproate planting and fertilizing equipment. Additional fertilizer is wasted through over-irrigation. More precise land-leveling equipment and improved irrigation-water management techniques need to be developed and applied.

VI. A STRATEGY FOR IMPROVING THE EGYPTIAN AGRICULTURAL INPUTS SYSTEM

A major factor in the realization of Egypt's agricultural potential will be the availability and efficient use of major agricultural inputs. The strategy to achieve these goals for major inputs requires coordinated policies of modernized credit practices, improvements in the inputs delivery system, more effective extension activity, expanded research and development, and more realistic pricing.

A. MODERNIZED CREDIT PRACTICES

The Principal Bank for Development and Agricultural Credit (PBDAC) has a vital role to play in the revitalization of Egyptian agriculture. It is the major distributor of agricultural inputs and the major source of credit for procuring loans aimed at farm machinery and soil amelioration, livestock and poultry production, establishment of orchards or other farm enterprises.

The major emphasis in lending activity has been on short-term loans mostly made in-kind. However, if the needs of a growing and dynamic agriculture are to be served, other kinds of short-term credit are needed. Longer term loans have been made, but the demand in some cases far exceeded both the bank's capacity to process loan request promptly and the supply of loan funds. Since the reorganization of the agricultural credit system in 1976, the PBDAC has established a fine record of on-time repayment of production loans and rapidly growing private deposits from rural areas. It is now in a good position to move prudently to adopt more liberal lending policies to serve small farmers and associated village enterprises.

B. IMPROVEMENTS IN THE INPUT DELIVERY SYSTEM

The PBDAC, as the major distributor of farm inputs, has a vital role to play in improving the delivery system. Improved facilities and improved procedures are required. For example, sizeable losses now occur in both the quantity and quality of fertilizers because of inappropriate packaging,

handling and storage. There is also a need to provide a greater variety of inputs to better meet the needs as seen by the farmers.

C. MORE EFFECTIVE EXTENSION ACTIVITY

Extension workers have a very important role to play in encouraging more effective use of inputs. They should assume the role of more effectively linking the credit services of the PBDAC with the needs of farmers. First, farmers need to be made aware of the loan programs that are available to them and how they should go about qualifying for them. Seocnd, the PBDAC should be made aware of the farmers' needs for credit and helped to devise sound policies for their lending activities.

There is a need for extension activity in farm mechanization. The lack of preventative maintenance by owners of tractors and mechanical pumps is a serious problem in many areas. Education programs would help to reduce this problem.

There are problems in the wasteful on-farm use of agricultural chamicals. Fertilizers are broadcast by hand and additional losses occur through over-irrigation. Extension programs promoting improved on-farm use could reduce these wasteful practices.

D. EXPANDED RESEARCH AND DEVELOPMENT

There is a need for expanded research and development regarding appropriate mechanization for Egyptian farming conditions. Improved machinery is required especially for fertilizer and seed placement, for improved pesticide application and for crop driers to reduce harvest time and intensify the crop rotations. This effort should draw on the experience of other countries with agricultural conditions similar to Egypt's as appropriate.

E. MORE REALISTIC PRICING OF FARM INPUTS

Most of the farm inputs in Egypt's agriculture, except agricultural labor, are now provided with one or more forms of subsidy. As price incentives for crops are permitted to adjust toward competing prices in international markets, the prices of farm inputs should similarly be adjusted to reflect the costs of domestic production or imports plus costs of distribution. This is a long-term goal that will permit Egyptian agriculture to adjust production to those commodities of highest competitive advantage. It will also encourage farmers to make investments and adopt practices that will reduce the wasteful use of inputs on the farm.

EGYPT: STRATEGIES FOR ACCELERATING AGRICULTURAL DEVELOPMENT

ANNEX F

CROP PRODUCTION

By

John Yohe, Crop Production, USAID

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ANNEX F: CROP PRODUCTION

I. INTRODUCTION

In 1975 the government of Egypt (GOE) and the U.S. Department of Agriculture (USDA) conducted an assessment of constraints to increasing agricultural productivity in Egypt. That study, published as Egypt: Major Constraints to Increasing Agricultural Productivity [USDA cooperating with the U.S. Agency for International Development (USAID) and the Egyptian Ministry of Agriculture (MOA), FAER No. 120 1976], became a basis for problem identification and design of agricultural projects for implementation by the GOE. Because major, if not fundamental, changes have occurred in the Egyptian economy and Egyptian agriculture since 1976, and because new opportunities for growth have appeared, the GOE requested USAID assistance in reassessing constraints to increasing agricultural productivity.

This section (the Crop Production section of the main report) deals with analyzing the crops production area within the agricultural sector and identifying opportunities for increased production of current crops grown, new crops and the intensification of existing high value crops which may contribute to both goals of increasing food security and providing for major opportunities to complement existing Egyptian agricultural exports.

Egypt's total agricultural crop production, Table 1, has increased from 21,317 million MT in 1971 to 25,524 million MT in 1981. This represents a total increase of 19.7 percent or an average increase of 1.9 percent per year. During this same period the rate of population increase has risen up to 2.9 percent in 1980. There has also been a significant rural-to-urban migration, and there has been a significant number of both professional agricultural scientists and rural laborers immigrating to lucrative job opportunities in Saudi Arabia and other

TABLE 1. EGYPT: PRODUCTION BY COMMODITY--VALUE AND INDICES OF AGRICULTURE AND FOOD PRODUCTION, ANNUAL 1971 - 1981.

COMMODITY	Price Weight $	Average 1969-71	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
	000 Metric Tons												
Wheat	82	1,509	1,732	1,618	1,938	1,894	2,034	1,960	1,697	1,933	1,856	1,796	1,838
Rice, Paddy	67	2,614	2,507	2,274	2,242	2,242	2,424	2,300	2,272	2,351	2,510	2,394	2,236
Corn	76	2,369	2,342	2,421	2,508	2,641	1,782	3,047	2,724	3,117	2,938	3,230	3,307
Barley	74	92	76	109	97	[illegible]	118	123	111	132	122	107	103
Sorghum	66	847	854	831	843	824	775	800	648	656	635	643	653
Broad Beans	156	277	256	361	273	234	234	254	270	231	236	213	208
Lentils	232	35	50	54	62	51	39	40	24	16	9	7	5
Potatoes	52	495	451	595	796	709	720	893	1,010	772	1,019	1,214	1,210
Sweet Potatoes	31	87	84	86	60	75	75	69	68	63	104	86	86
Onions	32	525	571	519	539	550	572	652	723	599	560	568	654
Sugarcane	6	7,107	7,498	7,713	7,276	7,918	7,902	8,446	8,721	8,296	8,791	6,616	8,618
Cotton	663	520	510	514	493	441	382	396	399	438	484	520	508
Cotton Seed	66	897	886	893	851	819	652	677	690	736	792	844	800
Flaxseed	177	12	10	13	17	23	24	24	30	31	34	34	27
Soybeans	230	1	1	1	2	2	2	11	27	79	106	72	130
Peanuts in Shell	201	38	33	31	28	25	28	28	30	33	33	32	33
Sesame Seed	279	19	21	24	21	14	17	13	18	9	13	16	17
Sunflower Seed	210	16	33	18	8	11	12	14	12	7	8	9	
Cabbage	26	271	275	278	283	299	321	329	340	348	360	353	374
Tomatoes	58	1,579	1,637	1,668	1,577	1,729	2,197	2,066	1,967	198	2,421	2,571	2,453
Oranges	38	633	707	684	769	819	856	755	671	843	1,050	921	895
Tangerines	38	88	101	83	89	90	97	85	76	85	98	70	73
Lemons	29	66	70	74	83	51	59	57	46	58	64	72	60
Apples	147	29	35	36	37	35	33	33	31	32	31	27	35
Pears	99	17	15	23	21	20	21	26	30	32	50	52	55
Bananas	97	89	95	108	101	110	112	112	127	113	113	133	137
Grapes	73	108	121	142	149	221	225	279	248	274	242	299	298
Olives	56	5	6	6	6	6	6	6	5	5	5	4	5
Dates	47	330	340	396	397	398	405	410	461	377	406	446	391
Meats	1,125	318	330	335	345	360	400	410	436	436	448	472	493
Milk	120	1,621	1,651	1,688	1,721	1,759	1,790	1,748	1,780	1,801	1,830	1,865	1,902
Wool, Greasy Basis	748	3	3	3	3	3	3	3	4	4	4	4	4

Source: Index compiled by ERS, USDA. Production data from FAS, USDA and Egyptian Ministry of Agriculture.

TABLE 1. EGYPT: VALUE AND INDICES OF AGRICULTURAL PRODUCTION, 1971 - 1981.

AGGREGATES OF PRODUCTION	1969-71	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
	Million Dollars at Constant Prices											
Crops	1,270.0	1,296.2	1,314.4	1,307.5	1,272.8	1,287.9	1,323.7	1,274.7	1,360.4	1,428.9	1,474.8	1,473.9
Livestock	554.9	571.6	581.7	596.8	618.3	667.0	673.3	707.1	709.6	726.6	732.5	786.2
Total Agriculture	1,824.9	1,867.8	1,895.1	1,904.3	1,891.1	1,954.9	1,997.0	[illegible]	2,070.0	2,155.5	2,204.7	2,260.1
Total Food	1,475.7	1,525.7	1,550.8	1,572.2	1,592.2	1,728.1	1,209.0	1,771.1	1,771.1	1,825.2	1,834.7	1,915.2
INDICES OF PRODUCTION	(1969 - 1971 = 100)											
Crops	100	102	103	103	100	101	104	100	107	113	117	116
Total Agriculture	100	102	104	104	104	107	109	109	113	118	122	125
Total Food	100	103	105	107	108	115	117	116	120	124	126	130
Per Capita Agriculture	100	100	99	98	95	96	96	93	95	96	96	94
Per Capita Food	100	101	100	100	99	103	102	99	100	101	99	98
Index of Population 1969-71 Population = 33,302,000	100.0	102.3	104.6	107.0	109.4	111.8	114.3	116.9	119.7	122.9	126.9	130.3

Source: Index compiled by ERS, USDA. Production data from FAS, USDA and Egyptian Ministry of Agriculture.

nearby Arab countries. Egypt thus faces a major challenge on how to increase the rate of growth in agricultural production in order for food at home and to generate foreign exchange with which to meet its future food requirements coming from increasing population pressures.

OVERVIEW OF EGYPTIAN AGRICULTURE

As described in the background paper prepared for the Strategies for Accelerating Agricultural Development (SAAD) Study, Egypt has one of the oldest agricultural production system in the world.[1/]

Egypt has an arid climate, which can be divided into three sub-types.[2/] Limited rain falls primarily during the four winter months, November through February. Along the Mediterranean coast and a few kilometers inland, the average annual rainfall ranges from 65-190 mm (2.5-7.5 inches). In this area some rainfed barley, castor, and tree crops, such as olives, are grown. All other crops throughout Egypt are grown with irrigation water. The Nile Delta and adjacent areas, which receive 25-65 mm (1.0-2.5 inches) of rainfall annually, have mild winter and warm, nearly rainless summers. Areas south of Cairo, in Middle and Upper Egypt, have mild, almost rainless winters and hot, rainless summers; the average annual rainfall is less than 25 mm (1.0 inch).

The total cropping area for Egypt (the Nile Valley and the Delta covers about 35,000 km^2 or about 3.0 percent of Egypt's total area. This is equal to about 5.4 million feddans of cultivatable land. The total annual area cropped in 1978 was about 11.2 million feddans. This

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[1/] S. Buchanan, J. Coyle, J. Parker, A. Attia, and M. El-Said. 1982. Egyptian Agriculture, Africa/Middle East Branch, International Economics Division USDA and Agricultural Economic Research Institute, Ministry of Agriculture, Egypt.

[2/] R. T. Odell, et al. 1979. Current and potential production and utilization of oilseed crops in Egypt. Cairo.

represents a cropping ratio of about 2:1. In regions where sugarcane and tree fruits are grown, the cropping ratio can be as low as 1.7, whereas cotton, wheat, maize, rice, sorghum, fava beans, lentils, onions, and berseem clover combine in various sequences to achieve intensity of about 2.0. The highest ratio occurs when shorter season vegetables are inserted in the system and the ratio increases up to about 2.5. Approximately 92 percent of the Egyptian land holders have tracts of five feddans or less (Table 2). The average size of holding for the total area, excluding state lands, desert, and land under distribution, is about two feddans.

Approximately 46 percent of the land is mostly on cash leases with rents not to exceed seven times the land tax. The fellahin (farmers) live in approximately 4,500 villages from which they travel to farm their usually scattered plots. The agrarian reform acts of the 1950's and 1960's, together with the traditional distribution of property amongst heirs, has led to substantial fragmentation. To reduce the inefficiencies of fragmentation, land use projects have been established on the old lands. This is where farmers group their lands into larger blocks in order to permit size efficiency gains from such operations as plowing and pest control. This have been very effective in pest control in cotton. The USAID projects (Rice, EMCIP, and ADS Horticulture) are using this technique effectively in their extension demonstration trials.

During the period of 1971-1980 the total production per unit area of some crops steadily increased by a factor of 1.1 for maize (1.7 times for all cereals) up to a 7.6 percent for potatoes and a drop of 6.2 percent for sugarcane (Table 3). Production per unit area of all crops was fairly constant for this period with the exception of onions which nosedived from 24.9 MT/ha in 1971 down to an average yield of 12.1 MT/ha in 1980. This precipitous decrease is entirely due to the problem of white rot of onions. In 1965 when the high dam was completed and irrigation water became available year round, the yield of onions jumped from 9.9 MT/ha in 1964 up to 28.8 MT/ha in one year. This decline from

TABLE 2. NUMBER AND SIZE OF FARMS IN EGYPT.

Size Class in Feddans	Number of holders		Area	
	In 1000	% of Total	Feddans in 1000	% of Total
1.0 and smaller	1,124	39.4	739	12.3
1.1 - 3.0	1,160	40.7	2,023	33.8
3.1 - 5.0	355	12.4	1,186	19.8
5.1 - 10.0	149	5.2	944	15.8
10.1 - 50.0	65	2.3	986	16.5
more than 50.0	--	--	106	1.8
TOTAL	2,853	100.0	5,984	100.0

Source: Some Statistical Indicators in the Egyptian Agriculture. November, 1978. Ministry of Agriculture, Institute of Agricultural Economics Research.

TABLE 3. EGYPT: AVERAGE YIELD OF SPECIFIED FIELD CROPS, ANNUAL 1950-1981.

Year	Wheat	Corn	Milled Rice 67%	Sorghum	Barley	All Cereals	Cotton Lint	Sugarcane	Onions	Tomatoes	Potatoes
1950	1,767	2,143	2,860	2,381	1,852	2,168	461	74,382	8,500	11,962	16,000
1951	1,923	2,044	2,048	2,381	2,018	2,084	436	75,056	9,333	16,480	15,909
1952	1,836	2,164	2,485	2,870	2,051	2,105	540	83,559	8,091	17,091	15,300
1953	2,058	2,190	2,228	2,381	2,114	2,174	522	83,864	7,769	12,543	17,000
1954	2,293	2,192	2,954	2,381	2,264	2,385	524	87,958	8,814	14,054	16,071
1955	2,268	2,226	3,348	2,926	2,223	2,464	439	88,064	8,646	14,200	15,167
1956	2,346	2,142	3,493	2,381	2,327	2,518	448	88,864	8,396	13,881	16,786
1957	2,307	2,012	3,579	2,[illegible]	2,345	2,484	536	89,783	8,589	14,047	16,000
1958	2,359	2,141	3,189	3,056	2,363	2,442	558	89,872	9,449	14,604	16,571
1959	2,32[illegible]	1,9[illegible]	3,394	2,381	2,381	2,418	618	91,957	8,455	14,239	17,000
1960	2,451	2,211	3,392	3,309	2,510	2,567	607	96,766	9,083	14,722	12,609
1961	2,470	2,471	3,428	3,548	2,617	2,688	403	92,464	9,083	14,246	17,044
1962	2,607	2,604	3,958	3,456	2,654	2,920	657	94,333	9,246	14,731	14,792
1963	2,643	2,583	3,730	3,566	2,637	2,935	646	92,071	10,073	14,667	16,800
1964	2,756	2,774	3,411	3,587	2,774	2,979	745	87,321	9,927	15,295	16,348
1965	2,645	4,070	3,399	3,838	2,476	3,412	745	88,755	28,792	15,525	16,348
1966	2,707	3,592	3,207	3,948	2,478	3,261	584	92,839	26,815	15,884	14,727
1967	2,451	3,451	3,420	4,018	1,754	3,159	640	90,707	26,739	13,977	16,353
1968	2,335	3,511	3,462	4,055	1,938	3,211	711	92,030	22,333	15,265	14,714
1969	2,405	3,783	3,456	4,084	1,887	3,277	796	96,718	20,172	15,317	16,233
1970	2,757	3,787	3,672	4,154	2,270	3,464	730	93,030	21,667	15,550	16,333
1971	3,039	3,664	3,801	4,116	2,585	3,487	796	89,897	24,958	16,106	16,107
1972	3,094	3,748	3,529	4,094	2,659	3,516	788	90,[illegible]	22,585	15,444	17,029
1973	3,069	3,603	3,674	4,161	2,694	3,626	729	82,[illegible]	26,950	13,595	17,733
1974	3,271	3,593	3,434	3,924	2,697	3,603	713	80,667	26,714	14,778	17,700
1975	3,471	3,618	3,713	3,780	2,810	3,586	676	85,891	28,714	15,380	17,561
1976	3,345	3,838	3,437	3,883	2,795	3,567	729	82,[illegible]	11,576	16,016	16,537
1977	3,347	3,676	3,520	3,767	2,775	3,409	647	83,052	11,653	15,131	16,833
1978	3,333	3,715	3,676	3,604	2,750	3,567	878	75,767	11,519	16,779	14,296
1979	3,178	3,714	3,885	3,713	2,711	3,566	9[illegible]	80,835	10,720	17,417	16,559
1980	3,224	4,034	3,915	3,738	2,675	3,728	1,013	82,934	12,085	17,755	17,343
1981	3,296	3,034	3,727	3,775	2,711	3,665	1,026	81,302	11,275	17,905	18,060

Source: CAPMAS and calculations by John Parker, ERS.

28.8 MT/ha down to 12.1 MT/ha is primarily due to the buildup of Schlerotium cepinarium, white rot, in the soil because of the ideal environment created fot it by year-round irrigation capability. There is no known genetic resistance and no practical control for this soil borne fungus.

During the same period (1971-1980) the hectarage devoted to cereal production showed little change, 1.921 million hectares in 1971 and 1,979 in 1980. During the interval of 1971-1980 cotton was the major agricultural commodity which decreased significantly in acreage. This decline probably is explained by the government's pricing policy and the marketing system compelling farmers to deliver their production to the government more than any other factor. The crops which have low fixed farm prices and a government regulated marketing system are the ones farmers tend to move out of. The farmers have moved toward the nonregulated crop areas and high cash opportunity crops, i.e., fruits, vegetables, forages, and crops which resulted in by-product availability for the livestock sector.[1/] The farmer has been relatively effective in exercising his own judgment in determining what his economic opportunities are within the bounds of what commodity allocations he has to accept within a given area.

In recent years because agricultural production per/unit area has seemed to either level off or even to decline in the case of sugarcane and onions, some have said that agriculture is operating at the edge of marginal return and that opportunities for expansion lay in the area of horizontal development, i.e., more land, institutional development etc. It is the purpose of this report to describe the dramatic opportunities that exist for increasing agricultural production and to indicate ways in which institutions in Egypt can act to provide the guidance, assistance and example by which the farmer can learn about improved technology which will help him to increase his productivity by a minimum of 25-50 percent.

[1/] Y. Wally. Strategy of agricultural development in the eighties. Ministry of Agriculture and Food Security, GOE.

Cropping patterns are briefly discussed in the opening chapter of the main report. Each year the Ministry releases a cropping pattern with the amount of land to be devoted to a given crop in a given year (Table 4). For discussion of government policies and how this influences farmer decisions, refer to the introductory chapter. These interventions, quotas, price controls, input controls and other factors affect the farmer to such an extent that he has gradually moved toward allocating his resources to livestock enterprises which are not under control. This has effectively caused berseem clover to assume a place within the cropping system which is inflexible under current policies.

TABLE 4. AREA OF MAIN CROPS BY SEASON.

Season and Crops	1950-52	1955-59	1960-64	1965-69	1970-72	1978-79	1980-81	1982
A. Winter Crops								
Clover	2,184	2,362	2,444	2,630	2,779	2,760	2,474	2,540
Wheat	1,561	1,501	1,387	1,268	1,297	1,386	1,363	1,400
Broadbean	328	353	365	349	300	280	282	300
Barley	122	135	128	110	81	110	94	88
Lentil	74	80	77	65	60	29	14	10
Onion	26	36	44	45	34	24	31	38
Fenugreek	53	60	55	38	27	26	26	15
Flax	8	14	27	30	25	65	60	52
Others	42	66	83	78	85	102	92	69
Vegetables	70	104	149	170	184	244	274	280
Subtotal	4,478	4,711	4,759	4,783	4,872	5,046	4,710	4,792
B. Summer Crops								
Cotton	1,765	1,791	1,751	1,694	1,568	1,193	1,212	1,100
Rice	505	641	791	1,028	1,140	1,033	963	1,150
Maize	29	56	271	1,078	1,178	1,892	1,907	1,900
Sorghum	386	393	414	462	461	420	411	400
Sesame	37	43	45	32	41	30	--	--
Groundnut	28	36	46	47	38	31	39	40
Others	13	14	46	54	88	173	28	33
Vegetables	120	200	260	328	339	483	503	475
Soybeans	--	--	--	--	--	104	96	150
Subtotal	2,979	3,285	3,716	4,868	5,047	4,967	5,159	5,248
C. Nili Crops								
Maize	1,717	1,794	1,456	432	341	--	*	*
Sorghum	52	56	55	45	32	--		
Others	23	24	18	31	31	132	105	37
Vegetables	69	91	138	170	170	251	227	275
Subtotal	1,861	1,967	1,667	678	607	824	332	302
D. Totals by Season								
Winter Crops	4,478	4,711	4,759	4,783	4,872	5,025	4,710	4,792
Summer Crops	2,979	3,285	3,716	4,868	5,047	4,967	5,159	5,248
Nili Crops	1,861	1,967	1,667	678	607	824	332	302
Orchards	94	114	147	208	298	336	377	350
Sugarcane	96	111	122	145	194	248	254	265
Total Cropped Area	9,412	10,077	10,289	10,537	10,774	11,148	10,832	10,957

Source: CAPMAS

* For years 1980-81 and 1982 maize area was reported as a total figure and did not fresh out summer and Nili maize crop.

II. GENERAL TECHNOLOGICAL, SERVICE AND INFRASTRUCTURE CONSTRAINTS

The immediate increase in productivity of Egyptian agriculture is not a function of availability of technology. Technology is available in all areas of crop production to increase productivity per unit area by a minimum of 50 percent and more depending upon the acceptance ratio of improved technology recommendations by the farmer. The immediate problem is one of how to effectively support the farmer in:

--improved irrigation management
--soil drainage
--availability of inputs
--information transfer
--improved seeds and
--research infrastructure

Application of improved production technology already on the shelf is the major link to achieveing a dynamic and strong improvement in crop yields. The above constraints are subsequently summarized.

A. IRRIGATION

This will be discussed in much greater detail in the Natural Resources section but it should be emphasized here that timeliness of availability of water to the farmer, especially the rice farmers is critical to maximization of potential from improved varieties, optimum cultural practices, and optimum dates for nursery planting and rice seedling transplanting.

Water use management is critical to all crops grown under irrigation. The Egyptian farmer is ignorant of good water management. He often follows the concept that if a little water is good then a lot more is better. The farmer needs to be educated through guidance and demonstration on good water management practices. This is true for all field crops,

vegetable crops, fruit crops and citrus crops. The magnitude of the problem is such that lack of water management on the farm and in the meska channels has contributed to over-irrigation, drainage problems, and increasing salinity problems due to high water tables and poor drainage. Recent studies show that farm yields may be reduced by as much as 40-50 percent due to any one or a combination of these problems.

The constraints and recommendations are covered in the soil and water resources section of the main report.

B. DRAINAGE

The creation of a dependable year-round irrigation capability from the Aswan High Dam in 1965 quickly resulted in a set of serious secondary problems in drainage and salinity. Again this is treated much more adequately in the section of natural resources, but it is highlighted here because of the basic nature of the problem. Because of the pressure to intensify production/multiple cropping per unit area, greatest emphasis was placed on water supply and very little on water management. As farmers quickly responded to free use of a seemingly inexhaustible supply of water, waterlogging and salinity problems began to appear before adequate attention had been given to drainage. The rising water table and associated salinity problems began to take its toll in reduced yields due to waterlogged soils, new soil disease problems, and toxic levels of salt. Yields in Egypt have been shown to increase by as much as 50 percent or more with proper drainage.

Constraints and recommendations are covered in the soil and water resources section of the main report.

C. AVAILABILITY OF PRODUCTION INPUTS

The availability of production inputs such as improved seed, fertilizers, pesticides and herbicides is critical to the success of any given crop the farmer grows. In terms of availability of seed or

fertilizer there is a critical period for the planting of wheat, maize, rice, and other crops within which crop yields can be maximized. The availability of chemicals is also critical to the control of crop pests, diseases and weeds. To be most effective control chemicals must be applied during early stages of disease or pest buildup within a crop. There is a time at which the disease or pest buildup increases in geometric proportions. During this stage, the damage is being done and it is only a matter of minimizing losses as opposed to controlling the problem if inputs were available at the proper time. Another dimension of this problem is recognition by the farmer on when pests or diseases begin to occur. The effectiveness of an education and guidance program of the extension service plays a great role here. The extension crop protection and disease specialists should be monitoring the buildup of pests and diseases so they can advise the farmers when to apply control measures. When that critical time is identified the inputs must be available or all may be lost.

Weeds are an innocuous problem which occurs everywhere. They have always been serious constraints in farmers' fields, where weed competition often seriously affects yield potential adversely. In Egypt weeds have also become a serious constraint along irrigation channels by impeding flow of water and at times even choking off water flow. Traditionally the only control has been by hand labor through pulling and the cutting of weeds. This has always been an expensive operation and has become more so because of the seasonal shortage of labor. The Agricultural Research Institutes under the Agricultural Research Center have identified herbicides for all crops which are effective under local conditions. As cropping system intensification continues, weeds will also increase problematically. The availability of herbicides as an input is critical to this phase of the farm operation.

Constraints and recommendations are covered under the inputs section of the main report.

D. INFORMATION TRANSFER

In Egypt there is a minimum of linkage between extension and the researcher. There seems to be a great gap between the technology transfer specialist working with the applied researcher in developing information sets which can be given to the farmer for application. There are many reasons for this which have been highlighted by a recent report which included recommendations for a strengthened agricultural extension program in Egypt.[1/] The effectiveness on how technology transfer can function in Egypt is illustrated by the success of the Egypt Rice Research and Training Project, the Egypt Major Cereals Improvement Project and the Tomato activity under the Horticultural Subproject of the Agricultural Development Systems Project. As an example, in 1981 the Extension Team of the Egypt Rice Research and Training Project conducted seven different applied research trials in 20 locations, and produced 1500 feddans of demonstration rice in 24 different locations. The team conducted a large number of field days with an estimated 30,000 farmers attending. In the demonstration trials covering 24 locations in six governorates, the average yield was almost 9 MT/ha. The maximum yields in the individual locations varied from 9.0 MT/ha up to 14.5 MT/ha. The average yield itself represented about a 61 percent increase over the Egyptian average yield. This is an indication of the great potential Egypt has to increase rice output. It illustrated how rice extension advisors, properly trained and receiving good technical backstopping can teach this technology to farmers. The lessons were the same for the other two commodity areas mentioned. Commodity constraints and recommendations are the subject of another review.

E. CERTIFIED SEED PRODUCTION

To maximize crop production, the system is no better or worse than the least effective link. Availability of quality certified

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[1/] E.T. York et al. Increasing agricultural production through more effective use of technology. Report of a U.S. Extension Study Team to the Ministry of Agriculture, GOE, and the USAID.

seed has been identified consistently as a major bottleneck of achieving a breakthrough on average yields at the farmer level. There are improved seed laws which have been passed, two of them being passed as early as 1926 and 1932. A third act in 1960, covered all crops and implemented seed certification programs as law. Little change has taken place since 1960, when the new policy was adopted. The general objective is to produce enough certified seed to cover one-half of the area for a given crop eacy year. Cotton and maize are exceptions. Cotton seed is renewed annually. Figure 1 graphically illustrates how the certified seed program works. The problems identified are that the General Department for Seed Production does not exercise great enough control of weed control, off types, and other causes of seeds not being truly certifiable. Because of the high seeding rates by Egyptian farmers (here is another area the Extension Service could have a great impact on) there is never enough certified seed to go around and so the farmer throws in a little of his own for good measure. The result is, in the case of rice, red rice being grown and not being rogued out.

Certified growers are paid a certain premium over the current price of the commercial crop and also to defray part of the cost of seed cleaning, bagging, transportation, certification, storage etc. It is unclear how effective this is as an incentive for growing certified seed.

An excellent discussion about production of certified seed is given by El-Tobgy.[1]

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[1] H. A. El-Tobgy. 1976. Contemporary Egyptian Agriculture. Second Edition.

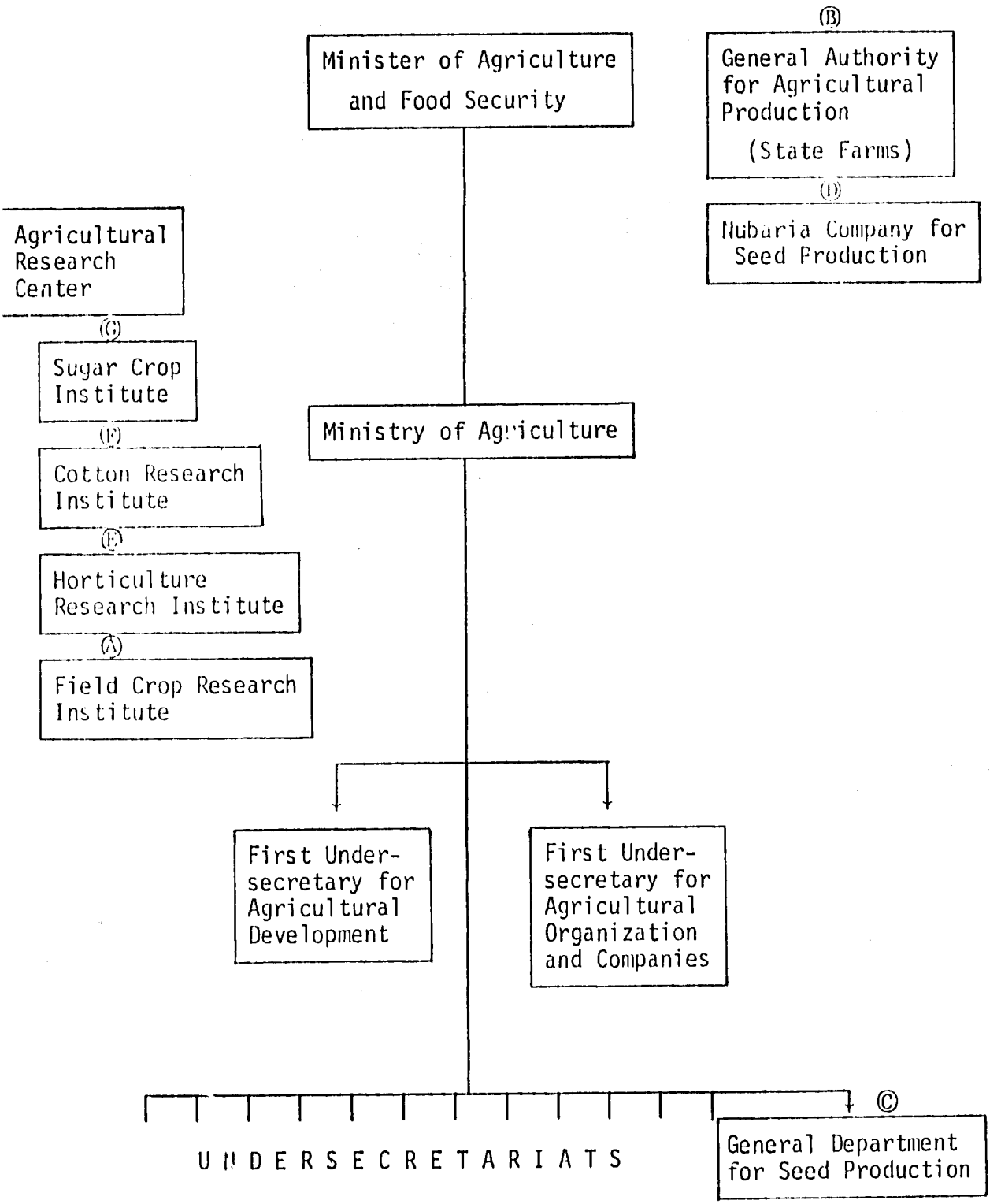

FIGURE 1. EGYPTIAN CERTIFIED SEED PRODUCTION

EGYPTIAN CERTIFIED SEED PRODUCTION

A. Each research section within the Field Crop Institute (except maize) is responsible for development and production of breeder seed and foundation seed. This seed is grown on State Farms where all Agricultural Research Stations are located (B).

C. All registered seed coming from Foundation Seed Fields on State Farms is released to the General Department for Seed Production for increase of Certified Seed. All Certified Seed is produced by contract growers throughout the country.

D. All vegetable breeder and foundation seed is the responsibility of the Horticulture Research Institute.

E. The Nubaria Seed Company is responsible for production of certified vegetable seed. This has not been too effective and vegetable production still largely depends on imported seed.

F. All registered seed from foundation seed increase plots from the Horticulture Research Institute are released to the Nubaria Seed Company for increase and distribution of vegetable seed.

G. All citrus and deciduous tree crops are the responsibility of the Horticulture Research Institute.

H. All cotton seed is the responsibility of the Cotton Research Institute for breeder and foundation seed. Different varieties of cotton are grown in discrete areas and ginned through cotton gins which handle only one variety. Samples from each seed lot are tested for seed purity, and for spinning quality. If lots fail to meet specifications they are thrown out. The Seed Department is responsible for handling and distribution of seed to the farmer.

I. The Sugar Crop Institute is responsible for multiplication and distribution of sugarcane sets. The procedure for sugar beet seed development is not firm as of yet.

J. All maize seed production is not under public control. Increase and distribution of open pollinated varieties and maize hybrids is being assumed by the private sector.

Major Constraints

--Labor--not enough labor to adequately supervise and manage certified seed production fields.

--Lack of mechanization on certified seed production fields.

--Seed-processing plants are old, out-of-date and poorly equipped. Efficiency is very poor. Of eleven seed-processing plants in Egypt, seven belong to state farms and only four belong to the seed production department. No trained staff to operate.

--Seed-testing--There are three-seed testing laboratories. They are old, poorly equipped and lack adequately trained personnel to operate. Output efficiency is very low.

--Poorly trained field inspectors--All farmer contract growers follow traditional practices. Field inspectors are not adequately trained to supervise farmer seed producers.

--Transportation--There is an absolute inadequate availability of transport for field inspectors to get around to supervise contract certified seed growers. There are 3000 field inspectors who supervise 100-200 feddans of seed production each.

--Technology transfer to farmers--Neither the Extension Service nor the field inspectors of the Seed Production Department have the knowledge or capability to instruct farmers on using recommended production and quality control technology in producing improved seed.

--Training--Of a staff of 5,000, there are no Ph.D.'s, only two to three M.Sc.'s, and about 4997 B.Sc. employees in the Department of Seed Production. Only two administrators have attended a seed production short course such as the one taught at Mississippi State University in the U.S.A. There appears to be no one capable of conducting training programs in Egypt on improved seed production technology.

--The new private seed firms, responsible for maize seed production need training in seed production technology and marketing. This initiative has great opportunity for success if government policies do not interfere with their capability to price their product to where it will not be profitable to operate.

Recommendations

- --AID should bring a team from Mississippi State University's internationally recognized Seed Technology Program for four to six weeks to conduct an in-depth feasibility study on improving the seed program structure in Egypt.
- --There should be a donor development project developed to assist in modernizing and upgrading the certified seed production capability in Egypt. This should include upgrading of infrastructure and include a significant training activity.
- --Consolidation of certified seed production fields should be implemented so that mechanization of production, pest control, disease control and weed control can be effectively practiced.
- --Strong linkages should be developed with extension and research to optimize production practices.
- --The two new private sector maize seed companies should seek assistance from the USAID centrally funded project on "Commercial Seed." This project is managed in the Agribusiness Division of the Human Resources Directorate, Science and Technology Bureau, AID.

F. RESEARCH INFRASTRUCTURE

Egypt has many highly qualified people in all fields of agricultural research. There are excellent higher education institutions which, though suffering from lack of laboratories, equipment and supplies, train scientists and technical people to work in most areas of the agricultural sciences. This es evidenced by the wealth of "shelf technology" already available that can initiate a green revolution in Egyptian agriculture. However, there are serious bottlenecks which prevent this from happening. In reference to assessing the potentials for increasing agricultural productivity, the following constraints are identified which impede the utilization of scientific and of technological knowledge.

--Poorly equipped and maintained laboratories in all research institutes. (Exceptions are those with which donor development projects are associated.)

--On all experiment stations, the land belongs to the General Authority for Agricultural Production (State Farm). The State Farm manages these lands from its institutional interests rather than putting the needs or research as a priority. (This may be temporarily solved for some areas where donor development projects are involved.)

--There are poor or nonexistent linkages and communications between institutes and the Extension Service. (The exception is again where donor projects are involved and incentives are given for communication and linkages.)

--There are not interdisciplinary teams in operation. (Exception is donor projects and the Cotton Research Program.)

--There appear to be no plans for institutionalizing donor development projects in agricultural research.

Recommendations

- --Develop a "Master Plan" for upgrading all agricultural research laboratories, stipulating equipment needs and staff requirements and allocating resources for implementation under MOA.
- --Establish National Research Programs, for example, an "All Egypt Major Cereals Program." Present institutes could be required to assign personnel to work on these programs at a given time commitment deemed necessary by a program leader and its advisory committee. Recommended programs are:

  a. Major Cereals Program
  b. Rice
  c. Oilseed Crops
  d. Legume Crops
  e. Horticultural tree crops (citrus and deciduous)
  f. Vegetable crops, including onions which are in the field crop institute at present

- --Upgrade Farm Mechanization Institute to an Agricultural Engineering Institute to include at least capabilities in:

  a. Farm mechanization
  b. Farm grain storage
  c. Design and fabrication
  d. Refrigeration
  e. Farm buildings, poultry and livestock structures
  f. Irrigation and drainage as applies to agriculture

III. ANALYSIS FOR POTENTIAL INCREASE IN CROP PRODUCTION

As discussed in the overview of Egyptian agriculture, the environmental setting in Egypt is based on irrigation and occupies an area of about 2.268 million hectares of land that is capable of producing crops 365 days per year. In comparison to world agriculture (mostly rainfed), Egypt ranks among the leaders in average production per unit area. However, this is misleading, because there is great opportunity and potential for increasing productivity in all crops by a minimum of 50 percent. To illustrate a more equitable comparison of production potential, Egyptian productivity is compared crop by crop with irrigated productivity in the United States, Table 5. The differences illustrate the great potential for renewal of a Green Revolution in Egyption Agriculture. There are obstacles and constraints which must be overcome before this potential is realized. However, assuming that "on shelf" technology is the starting point and that GOE Agricultural Policy and an effective technical information transfer capability is available to support agriculture, then the following discussion of potential is within the short term grasp of each small farmer in Egypt.

To assess initial potentials for realistic increased productivity and what can be realistically expected from the small farmer, yield increases will be something less than the optimum which is demonstrated by experiment station yields and demonstration yields supervised by agricultural professionals.

To illustrate this point, the experience of differences between experimental and commercial farm yields in the State of Illinois is presented. "Soybean yields from an experiment on herbicides were 3.64 MT per hectare during the period 1972-75. Yields on commercial farms in East-Central Illinois during that period were 2.26 MT/ha. In the same experiment, maize yields were 9.7 MT/ha, with yields on commercial farms of 7.05 MT/ha. Note that the soybean yields on commercial farms were 62 percent of those on experiments and that

TABLE 5. COMPARISON OF U.S. RAINFED AND IRRIGATED CROP YIELDS WITH EGYPTIAN IRRIGATED CROP YIELDS.

	U.S. Yields MT/ha				Egypt Yields MT/ha	
	Rainfed		Irrigated		Irrigated	
	Average	Maximum	Average	Maximum	Average	Maximum
Maize	4.8	12.0	9.1	15.15	4.0	10.0
Sorghum	2.9	7.1	6.5	10.3	3.8	9.0
Rice	-	-	5.5	13.4	5.6	9.5
Wheat, hard red	1.9	4.9	2.3	7.8	3.3	5.5
Barley	3.3	6.7	5.7	12.5	2.7	3.1
Sorghum	2.0	4.0	3.4	6.1	2.6	3.0
Sunflower	1.3	2.8	2.8	4.5	2.2	2.5
Sesame	0.8	1.3	2.0	2.2	0.8	1.0
Peanuts	2.8	5.6	3.4	6.7	2.4	2.5
Cotton Upland						
a. Mississippi	0.67	1.4	-	-	0.8	1.8
b. California	1.6	2.5	-	-	0.8	1.8
Cotton, c. Barbadense	0.9	1.8	-	-	1.0	1.4

maize yields on commercial farms were 72 percent of those on experiment."

For this analysis a factor of 65 percent of experimental or demonstration yields will be used to assess the realistic production potential in the near term on small farms.

A. CEREALS

1. Rice

Rice is one of the major field crops in Egypt. Over the last 16 years (1965-80) the area planted to rice has been about 445,000 hectares and the average yield has been fairly static ranging from 5.7 MT/ha of paddy rice in 1965 up to a high of 6.2 MT/ha in 1973 and falling back to 5.6 MT/ha in 1980, Table 3.

In comparison to world averages, Egypt ranks third behind South Korea and Japan, Table 6.

Rice is the second most important agricultural export commodity following cotton. Most recently, however, due to stable yields, increasing domestic demand from increasing population pressure, rice exports of milled rice have fallen from 211,000 MT in 1976 to a low of 95,000 MT in 1981. The reversal of this trend is unlikely unless significant gains can be made in yield per unit area.

Rice is a summer crop and is grown immediately after a winter crop, usually long-term berseem clover or wheat, Figure 2. Because rice is grown under water and requires a critical irrigation regime, the major rice growing area has been restricted to the northern half of the Nile delta, where a special water availability schedule of four days on and four days off is made available. The six northern governorates of Dakahlia, Kafr El-Sheikh, Beheira, Sharkia, Gharbia and Damietta account for about

TABLE 6. TOP NATIONAL AVERAGES OF RICE, 1975-77 (T/ha).

Country	1975	1976	1977	Average
Republic of Korea	5.324	5.961	6.603	5.726
Japan	5.954	5.295	5.929	5.726
Egypt	5.484	5.077	5.205	5.255
USA	5.120	5.244	5.045	5.136
Average	5.470	5.394	5.695	5.520
World Average	2.477	2.456	5.525	2.486

MONTH	LAND PARCEL #1	LAND PARCEL #2	
October			
November			
December			
January	Berseem	Wheat	Berseem
February		or	or
March		Barley	Legumes
April			
May			
June			
July			
August	Cotton	Rice	
Spetember			

FIGURE 2. TYPICAL TWO-YEAR RICE ROTATION.

97 percent of the rice growing area. The soils in this area are generally characterized by low fertility, low productivity and are to a large part plagued with problems of salinity.

The rice grown in Egypt is the short-grain or Japonica type. The traditional practice by farmers was to direct seed in the paddy field prior to flooding. Currently, the farmer prepares his nurseries in May or June to raise seedlings. Due to unsure water supplies excess seed is used, 60-80 kg whereas 20 kg is more than adequate. Transplanting is done in June and July after the fields have been plowed two or three times. The fields will have been worked under water on the last operation, called tabouting, to break clods, bury weeds and to smooth the surface.

Transplanting is done when the seedlings are 35-50 days of age with as many as 12 to 20 plants per hill. The hills are spaced at random and vary in distance from 25 to 50 cm or more apart. Two to three weeks after transplanting the field receives the first fertilizer application of nitrogen and phosphorus. The second is applied about three weeks later, presumable at panicle initiation. The field is weeded by hand about four to five weeks after transplanting.

Water is applied each time the irrigation schedule allows after transplanting. At times the water is completely gone and the soil cracks open before the next irrigation water is available. A constant flooded condition should be maintained.

The field is drained about two weeks before harvesting. The harvest is by hand with a sickle and the crop is allowed to lay on the soil for three to four days before being bundled. After bundling the crop is hauled by animal or cart to a central village threshing floor where it is spread upon the ground and threshed by running over it by tractor. When the threshing is completed,

the straw is removed and the rice is them winnowed to remove the chaff. The rice is then sacked and delivered to the cooperatives.

Field consolidation has been practiced since 1965. This helps overcome the problems associated with the extreme fragmentation of the small holdings of the numerous farmers and allows consolidation of as many individual small rotations into as reasonably large blocks as possible. The minimum consolidated area in any one single rotation is 20 feddans, but in actual practice the area may be larger, up to 200 feddans.

Currently the major rice varieties are 'Giza 171' and 'Giza 172.' These new varieties replaced 'Nahda,' an Egyptian selection made in 1954 form some Japanese material. 'Nahda' occupied only 5 percent of the rice acreage from 1958-1977 when the new varieties became available. Rice yield potential through a combination of improved varieties, improved agronomic practices, proper availability of water and mechanization has the potential of yielding 9.5 MT/ha. This is about a 70 percent increase in yield over the current average yield. With current "on shelf" technology the rice extension team of the Ministry of Agriculture, GOE and USAID Rice Research and Training Project demonstrated this potential on 630 ha of farmer demonstration fields in 1981. This project demonstrated how current technology with properly trained and motivated extension rice production advisors working with 829 farmers on 630 ha in the six rice Governorates could produce outstanding yields, Table 7.

Constraints to Increased Production

--Lack of superior varieties with traits of lodging resistance and bird resistance.

--Failure to use recommended cultural practices.

TABLE 7. RICE YIELDS FOR 1981 (Samples, Tons/ha).

GOVERNORATE	DISTRICT	DEMONSTRATION FIELDS	
		MAXIMUM YIELD	AVERAGE YIELD
Dakahlia	Aga	11.5	10.2
	Aga	10.7	9.3
	Sherbin	10.0	7.7
	Belkas	12.6	9.5
	Meet Seet	10.2	9.5
Kafr El-Sheikh	Bialla	10.0	8.8
	K. El-Sheikh	14.5	10.2
	Desouk	10.0	9.3
	Kellin	9.0	8.1
	Karoger	10.7	7.7
Demiata	Kafr-Saad	9.6	8.8
	Demiata	9.0	8.6
El Bahera	Mahmoudia	9.2	8.8
	Kafr El-Dawar	10.7	9.5
	El-Kazzaan	8.8	6.0
	Abou Homous	10.0	8.8
	Damanhour	11.9	10.7
El-Sharkia	Zagazig	11.4	9.5
	El-Kenayat	10.0	9.5
	Kafr Saker	10.7	8.6
	Fakous	8.8	7.6
Gharbia	Mehala Kobra	8.8	6.9
	Basion	10.5	9.5
	Tanta	9.0	6.9
Average		10.32	8.75
Percent increase over Egypt average yield of 5.7 MT/ha		81%	54%

Source: Annual Report of Extension Team for 1981 Season, Rice Research and Training Project, MOA.

--Unavailability of certified seed.
--Few trained extension advisors to cover the six rice-producing governorates.
--Little available land for increased production.
--Quantity of water for rice is not always on a timely schedule.
--Mechanization is needed to keep a timely schedule in field preparation and harvest.
--Shortage of labor at required critical times.
--Unavailability of inputs, e.g. fertilizer, pesticides etc.

Recommendations

- --Establish an "All Egypt Rice Program." See recommendations under Research Infrastructure. This will institutionalize the California Rice Project.
- --Establish effective research technology transfer system.
- --Continue to investigate methods for mechanization of seedbed preparation and harvesting.
- --Eliminate price constraints.
- --Upgrade availability of inputs, including irrigation water on appropriate timely basis.
- --Continue excellent research and extension activities initiated under California Rice Project.

2. Wheat

Wheat is the major winter cereal grain crop and the third major crop in terms of planted acreage. Over the last 16 years (1965-1980) the area planted to wheat has varied from 481 thousand hectares up to 602 thousand in 1968. The average for this total period was 551,750 hectares. Most recently Egyptian farmers planted 588,000 hectares of wheat in 1981, Table 8. Average yields, during this period ranged from 2.6 MT/ha in 1965 up to

TABLE 8. EGYPT: AREA OF PLANTED SELECTED CROPS, ANNUAL 1950-80, AND ESTIMATE FOR 1981.

Year	Wheat	Corn	Rice	Sorghum	Barley	Total Cereals	Cotton	Sugar Cane	Onions	Tomatoes	Potatoes
	1,000 hectares										
1950	576	610	294	165	49	1,694	829	34	30	26	10
1951	629	695	205	178	50	1,757	832	36	33	25	11
1952	589	716	157	182	57	1,701	826	39	33	33	10
1953	752	897	178	204	49	2,080	556	44	30	35	22
1954	754	800	256	192	51	2,053	663	48	43	37	14
1955	640	777	252	184	57	1,910	763	47	48	40	12
1956	660	771	290	201	55	1,977	694	46	468	42	14
1957	636	743	307	189	56	1,931	764	46	56	43	15
1958	599	821	318	178	57	1,873	800	47	49	48	14
1959	620	781	306	196	59	1,962	739	47	66	54	22
1960	612	765	297	190	62	1,926	787	47	60	57	23
1961	581	673	226	192	51	1,723	834	47	60	61	23
1962	611	769	349	191	55	1,975	696	51	65	67	24
1963	565	723	403	203	51	1,945	684	56	69	72	25
1964	544	698	404	208	53	1,907	677	56	68	78	23
1965	481	526	356	210	53	1,626	677	49	24	80	23
1966	542	662	355	217	41	1,817	781	56	27	86	22
1967	530	628	452	220	65	1,895	683	58	23	88	17
1968	602	655	507	225	65	2,054	615	66	21	98	28
1969	531	626	502	199	62	1,920	681	71	29	101	30
1970	551	633	480	210	37	1,911	685	75	21	100	30
1971	567	639	478	207	30	1,921	641	78	24	104	28
1972	523	646	481	203	41	1,894	652	85	23	108	35
1973	525	69[illegible]	419	205	36	1,881	672	80	20	116	45
1974	576	665	490	212	32	1,975	610	87	28	117	40
1975	586	769	442	205	42	2,044	565	92	21	137	41
1976	586	794	453	206	44	2,093	524	102	59	129	54
1977	507	777	437	205	40	1,966	598	105	61	130	60
1978	580	839	436	182	48	2,085	499	104	52	131	54
1979	584	791	433	171	45	2,024	502	105	49	139	59
1980	557	802	408	172	40	1,979	523	105	48	143	61
1981	588	714	462	168	38	1,970	493	104	50	153	64

3.5 MT/ha in 1975 and dropped back to 3.2 MT/ha in 1980, Table 2. This represented an average increase in yield per unit area of 1.5 percent per year. In comparison to world standards 3.2 MT/ha is quite high, however, for wheat production under irrigated conditions these yields are quite mediocre.

Wheat is the major winter cereal grain crop and the major cereal in the Egyptian diet. Imports of wheat have escalated from 2.5 million tons in 1974 to 5.4 million tons in 1980. In 1980 Egypt only produced 1.8 million tons which represented only 25 percent of total requirements. It is estimated that under present policies that wheat and wheat flour imports will increase up to 8.0 million tons in 1985 and 10.0 million metric tons by 1990. The current (1981) average yield for wheat is 3.33 MT/ha. Present "on shelf" technology has demonstrated that yields could be increased by a factor of 65 percent or up to 5.5 MT/ha (Table 9). The program that demonstrated these capabilities was conducted by the extension activity of the Egyptian Major Cereals Improvement Project's wheat program.

Working with 6,363 participating farmers growing 2,455 hectares (38 ha average per farmer) of wheat in eight governorates they demonstrated that an extension effort correctly organized could induce farmers to plant wheat in consolidated fields, within specified areas and that the farmers were willing to follow recommended practices. The project was implemented in 65 districts on consolidated areas of approximately 42 hectares in size.

In addition to showing significant increased yields of grain per unit area, straw production was also increased by about 32 percent. The average net increase per farmer was LE 140.45 per hectare, Tables 10 and 11.

TABLE 9. EGYPT: CROP PRODUCTION DEVELOPMENT POTENTIAL.

Crop	Current Situation (1951)			Potential Yield Verified by Demonstration	65% Farmer Acceptance of Recommendations			Total Increased Production
	Area 000 HA	Yield MT/HA	Production 000 MT	MT/HA	Area	Yield	Production	000 MT
A. Cereals								
1. Maize	714	4.03	2,877	10.0	714	7.91	5,648	2,771
2. Wheat	588	3.33	2,958	5.5	588	4.74	2,787	829
3. Rice	462	5.56	2,568	9.52	462	8.13	3,756	1,188
4. Barley	38	2.70	103	3.07	38	2.94	112	9
5. Sorghum	168	3.80	638	9.0	168	7.18	1,206	568
B. Vegetables								
1. Tomatoes	155	17.90	2,774	83.3	155	60.4	9,363	6,589
2. Onions	50	11.27	563	47.6	50	34.9	1,744	1,181
3. Garlic	10	14.5	145	19.0	10	17.4	174	29
4. Potatoes	64	19.03	1,154	47.6	64	37.3	2,387	1,233
C. Fruits								
1. Citrus	75.1	13.5	1,013	47.6	75.1	30.6	2,298	1,285
2. Apples	2.3	16.6	39					
3. Peaches	1.1	19.0	21					
4. Apricots	2.0	14.3	29					
5. Pears	4.4	16.6	73					
6. Grapes	24.0	12.3	295					
7. Mangoes	11.9	8.3	99					
D. Forages								
1. Berseem		47.6		30.0				
2. Alfalfa	-	-	-	4.0				
3. Sorghum				33.0				
4. Grasses								
E. Food Legumes								
1. Fava Beans		2.4		3.0				
2. Soybeans		2.4		3.0				
3. Lentils		1.1						
F. Sugar Crops								
1. Sugarcane	105	80.9	8,495	166	105	136	14,280	5,785
2. Sugar beets	9.2	36	331	70	9.2	58	534	203
G. Fiber Crops								
1. Cotton								
a. 1 3/8" Staple								
b. 1 1/4" Staple								
2. Flax	15.5	1.1		0.54				
3.		2.4		1.36				
H. Oilseed Crops								
1. Sunflower		2.2		2.5				
2. Peanuts		2.4		2.5				
3. Sesame		1.0		0.84				

TABLE 10. 1980/81 WHEAT PROGRAM: FARMERS AND AREA INVOLVED, COSTS AND VARIETIES BY GOVERNORATES.

Governorate	In Program			Costs (LE)				Variety
	Districts (No.)	Farmers (No.)	Area (fds.)	Incentives Budgeted (a)	Incentives Paid-Out	Administrative (b)	Total (c)	(Mostly)
Dakahlia	10	1,143	962	22,000	19,240	6,077	25,317	157 & Sakha 8
Kafr El-Sh.	6	336	500	12,000	10,000	3,646	13,646	Sakha 8
Gharbia	8	1,064	826	16,000	16,520	4,862	21,382	G 157
Menoufia	8	951	720	12,000	10,800	4,[illegible]2	15,662	G 157
Beni Suef	7	677	692	14,000	13,840	4.254	18.094	G 155
Minea	9	578	886	18,000	17,720	5,468	23,188	G 157
Assiut	7	534	480	16,000	9,600	4,254	13,854	G 157
Sohag	10	1,080	778	20,000	15,560	6,077	21,637	G 155 & Stork
TOTAL	65	6,363	5,844	130,000	113,280	39,500	152,780	--

(a) Based on a planned total area of 6,700 feddans, at LE 20 per feddna, except in Menoufia where the rate was LE 15.

(b) Total costs assigned by the EMCIP accounting office to the wheat program less incentives paid to farmers plus salary incentives to the District Agronomists plus allowances for in-country training plus 15% for overhead. This was prorated by Governorates based on number of Districts in the programl

(c) Based on paid-out incentives plus adminstrative costs.

TABLE 11. 1980/81 WHEAT PROGRAM: YIELDS PER FEDDAN IN AND OUTSIDE THE PROGRAM AND NET INCREASE IN RETURNS.

Governorate	Yields (Tons/feddan) In Program		Control (a)		Increase in Yields (%)		Net Increase in Returns (c) To farmer (LE/F)		Total for Programs (c) (1,000 LE)
	Grain	Straw	Grain	Straw	Grain	Straw	with incentives	without incentives	
Dakahlia	2.53	3.23	1.66	2.77	52	17	121	101	91
Kafr El-Sheikh	2.27	2.91	1.35	2.66	68	9	32	12	2
Gharbia	2.33	3.28	1.49	2.16	56	52	68	48	35
Menoufia	2.38	3.46	1.50	2.67	59	30	69	54	34
Beni Suef	2.51	2.05	1.30	1.54	93	33	142	122	80
Minea	2.30	2.10	1.52	1.70	51	24	44	24	16
Assiut	2.00	2.62	1.25	1.95	60	34	51	31	11
Sohag	2.20	3.20	1.20	2.00	83	60	96	59	53
TOTAL or AVERAGE	2.31	2.86	1.41	2.18	64	32	78	59	322

(a) Based on a random sample of farmers in the same villages as those having demonstration programs.

(b) Based on market prices expected by farmers at the time of the farm survey. Included both grain and straw. No allowance was made for land costs.

(c) Per feddan retursn per farmer minus incentives times number of feddans in the program from Table 1 less administrative costs for the progaam as shown in Table 1.

Source: EMCIP Wheat/Barley Extension Annual Report.

Assuming that the Egyptian farmers will adopt improved technology and that an effective technology transfer system is available to all, it is estimated that average yields per unit area may be about 65-70% of what experiment station technology can produce. In this analysis, though, the ratio of effective implementation is being applied to results obtained from demonstration trials. Thus, the new technology package based on "on shelf" technology will increase total wheat grain output by an estimated 829,000 metric tons. An additional increase in straw yields from the improved varieties and practices would amount to an increase of 1.05 MT/ha of straw or a 618,682 MT increase on the 588,000 hectares of wheat grown.

Constraints to Increased Production:

--Lack of superior varieties, disease and pest resistant, lodging resistant, high straw yielding, and bird resistant.

--Unavailability of imports, fertilizers, pesticides, herbicides, and improved seed on timely basis.

--Soil salinity associated with poor water management, excess irrigation and poor drainage.

--Poor cultural practices--farmers don't achieve optimum plant populations (stand) and are thus too low to produce high yields or to even utilize high nitrogen applications.

--Farmer reluctance to accept improved varieties.

--Poor management practices, i.e., poor weed control, poor tillage, late planting, and late harvesting (results in grain lost in shattering during transport) and finally, lack of mechanization for harvesting.

--Insect and disease damage, i.e., aphid damage on late plantings, leaf, stem and stripe rusts.

--Inefficient seed multiplication and distribution mechanism for high quality certified seed.

--Ineffective extension education system for farmers.

--Lack of effective interdisciplinary team research. Poor cooperation and communication within institutes and departments within the Ministry of Agriculture.

Recommendations

- --Institutionalize present major cereals improvement project, i.e., "All Egypt Major Cereals Improvement Program." See recommendation under Research and Infrastructures.
- --Assure availability of production inputs on timely basis.
- --Upgrade technology transfer system to farmers to assure proper training in production and management using new production practices, including training in good water management.
- --Continue to investigate optimum methods for mechanical harvesting and/or threshing of wheat/barley.
- --Improve the Seed Production Department, to where it can assume all certified seed production. See recommendations under certified seed production section.
- --Continue research on new adapted high yielding varieties and cultural requirements to assure a continuing production potential, i.e., pest resistance, disease resistance, etc.

3. Maize

White maize has traditionally been the major cereal crop for making bread in the rural areas; however, since subsidized wheat flour has been made available at the village level, more maize will become available for use in the growing poultry and livestock industries in Egypt. Maize is the second most important crop in terms of area planted. The area planted was 633,000,800 and

715,000 hectares in 1970, 1980 and 1981, respectively. Maize is a summer crop, grown primarily in Delta and middle Egypt. Annual production has been about 3 million metric tons. At least 40 percent of production has been used for livestock and poultry feed. Increased demand for poultry feed resulted in 1.4 million MT of maize used as feed grain in 1981 as opposed to 944,000 MT in 1980.

Average yields at the farm level have ranged from 3.5 MT/ha in 1966 up to 4.03 MT/ha in 1981. From data generated from a farm testing trial in 1980 which was designed to verify a production package of cultural practices using elite new varieties and hybrids it was found that in general, yields tend to be higher in middle Egypt than in the Delta region. The grain yield was 7 MT/ha across locations or 74 percent greater than the national average. This was due to a combination of favorable factors such as planting in better soils, better farmers, no leaf stripping, application of 214 kg N/ha, high plant population density and continuous monitoring of plots for pest control.

In 1981 the performance of the new variety 'Giza 2' was compared to the 'Pioneer' hybrid 514. Table 12 shows the preliminary data on that comparison. 'Giza' in this test produced an average of 15.26 MT/ha or 379 percent greater than the national average. From personal communication with D. A. H. Shehatta, leader for the maize program, the 1981 farmers verification trials (2940 ha) resulted in an average yield of 8.7 MT/ha or an average increase of 215 percent increase over the national average yield.

A practice which has reduced average farmers yields nation wide has been the stripping of leaves during the growing season to provide green fodder for livestock feed during the summer. The maize program devised a scheme by which the farmer could raise green fodder without stripping leaves. They tested on all areas

TABLE 12. COMPARISON OF NEW VARIETY GIZA-2 AND PIONEER HYBRID 514 IN THREE TIRALS IN 1981.

TRIAL	VARIETY (MT/ha)	
	PIONEER 514	GIZA-2
AH/1	10.5	14.5
AH/6	12.5	14.8
AH/10	13.2	16.5
AVERAGE	12.06	15.26

of the verification trials, a practice where the farmers set aside 1/10 of the acreage to grow a forage sorghum or Sudan grass. The results of experiments to demonstrate the benefits of that practice are presented in Table 13. From this data, the improved variety and improved practices improved yield by 127 percent. Even with the stripping of leaves the improved variety increased yields 54 percent. The data from this table indicates increased productivity may be 50 percent due to improved variety and 50 percent due to improved practices.

It is apparent that there is great potential to increase maize production in Egypt in the short term. The technology is presently ready for application.

Constraints to Increased Production

--Need for improved seed delivery--There is a serious problem of certified production of maize seed.

--Need for technology transfer--Ineffective extension education system for farmers.

--Lack of marketing and credit coops--There is a big problem of buying farmer production and putting it into the system for livestock and feed industry use.

--Soil salinity and alkalinity.

--Drainage--Water management education is needed; there is no extension program to teach farmers about correct water management practices.

--Defoliation of maize leaves for summer livestock feed.

--Availability of inputs on timely basis.

--Pricing policy for grain.

TABLE 13. COMPARISON OF SUMMER FORAGE SYSTEMS FOR LOCAL PRODUCTION OF GREEN LIVESTOCK FEED.

Package of Practices Treatments	Maize Yield MT/ha
A	3.7
B	5.7
C	5.7
D	8.4

A. Farmers variety with former management practices, including stripping of leaves.

B. Farmers variety with improved package of management practice.

C. Improved variety with former management practices including stripping of leaves.

D. Improved variety with improved package of management practices.

Recommendations

- --Seed assistance from "Commercial Seeds" Technical Assistance Project, Agribusiness Division, Directorate for Human Resources, Science and Technology Bureau, USAID, Washington. This project is designed to assist in development of new private-sector seed companies.
- --Institutionalize the EMCIP Major Cereals Project. See recommendations under Research and Infrastructure section.
- --Promote nationwide adoption of practice whereby 1/10 of maize area is set aside for high-yielding sorghum fodder production to provide summer livestock feed. Eliminate defoliation of maize for green fodder.
- --Provide all production inputs on timely basis. See Inputs section for recommendations.
- --Provide extension education and training to all farmers, including guidance on production, protection, water management, recommended varieties and marketing/storage advice. See recommendations of recent extension review teams.

4. Sorghum

Grain sorghum grown as a summer crop in upper Egypt is more tolerant to hot, dry areas that are marginal for maize production. In upper Egypt a white-grained sorghum has been preferred as the main staple in the rural diet, where it serves as the main bread cereal. Dry sorghum leaves are used as fodder for livestock and the stalks are used for cooking fuel and for building huts. From 1970 to 1977, the area of sorghum changed very little, fluctuating around 205,000 hectares per year. However, in 1978 the area dropped to 182,000 hectares and in 1981, the smallest area in 30 years was grown, 168,000 hectares. Sorghum yields, primarily due to improved varieties has increased from 2.4 MT/ha in 1950 up to 4.2 MT/ha in 1973. Since 1973 yields have fallen to 3.8 MT/ha.

TABLE 14. GRAIN YIELD OF ELITE MAIZE VARIETIES AND HYBRIDS AS COMPARED TO FARMERS' VARIETIES WHEN A RECOMMENDED PACKAGE OF PRACTICES IS IMPLEMENTED UNDER FARMERS' CONDITIONS, 1980.

VARIETY	LOCATION: Kafr El Sheikh	Delta Gharbia	Delta Menoufia	Sharkia	Beni Suef	Minia	Sohag	Average Across Locations
	MT/ha							
Composite-2	7.7	6.6	8.8	7.6	7.3	7.7	9.0	7.9
Composite-3	6.6	5.7	8.6	6.5	7.5	5.6	8.3	7.0
D.C. 425	7.4	4.7	9.2	7.5	8.3	6.2	8.6	7.4
G-4787 W	5.1	4.8	10.1	7.0	7.4	5.4	6.7	6.6
Local	4.3	4.4	6.8	6.6	6.6	4.4	8.9	6.0
Location Average	6.22	5.24	8.7	7.0	7.6	5.9	8.3	7.0

These yields still rank very high among all sorghum growing countries. In the past there had not been extensive research on sorghum. Now, under the EMCIP Major Cereals Project greater emphasis is being placed on yield improvements as greater demand is being generated for locally grown cereals for the growing poultry and livestock industries.

Potential for Increased Production

Though average yield per unit area in Egypt has been quite high by world standards, there is till great opportunity to increase productivity even further. In 1981 the extension team of the EMCIP Maize/Sorghum program set out demonstration fields in eight districts of Assiut Governorate and ten districts in Sohag Governorate. They used the variety 'Giza 15.' Research recommendations were applied as a package. The major constraint in implementation was the lack of available phosphate fertilizer at the time of planting. The results from this research are presented in Table 15.

Sorghum is traditionally threshed, after cutting the heads, by hand with long sticks. The project tested a multicrop thresher-winnower with great success. The farmers were able to thresh .42 hectare of sorghum in 1 to 1 1/2 hours.

The major pests of sorghum are stem borers, spiders, aphids, grellotalpa, cotton leaf worm and green worm. Control of these pests required constant monitoring throughout the trials.

With only a single improved variety at present, yields were substantially improved by 63 percent. The farmers were willing to follow instructions and the potential for increasing yields was demonstrated.

TABLE 15. SORGHUM DEMONSTRATION YIELD, 1981.

TYPE OF FARMER	SORGHUM YIELD, MT/ha		%
	RANGE	AVERAGE	INCREASE
Demonstration	1.3-2.9	6.2	63
Local Farmer	1.5-1.7	3.8	-

The total number of farmers participating in the trials were 736 with an average of 0.5 ha per farmer. There was a total of 249 hectares in the demonstrations. The farmers in these areas have already asked for maize seed in addition to sorghum seed for the 1982 growing season.

Constraints to Increased Production

--Need for improved seed delivery--There is a serious problem of certified production of sorghum seed.

--Lack of effective technology transfer--Ineffective extension education system for farmers.

--Need for marketing and credit coops--There is a big problem of buying farmer production and putting it into the system for livestock and feed industries.

--Soil salinity and alkalinity.

--Drainage and the need for water management education--There is no extension program to teach farmers about correct water management practices.

--Defoliation of sorghum leaves for summer livestock feed.

--Unavailability of inputs on timely basis.

--Inadequate pricing policy for grain.

Recommendations

- --Seed assistance from "Commercial Seeds" Technical Assistance Project, Agribusiness Division, Directorate for Human Resources Science and Technology Bureau, AID, Washington. This project is designed to assist in development of new private sector seed companies.
- --Institutionalize the EMCIP Major Cereals Project. See recommendations under Research and Infrastructure section.
- --Promote nationwide adoption of practice for setting 1/10 of maize area aside for high-yielding sorghum fodder production to provide summer livestock feed. Eliminate defoliation of sorghum for green fodder.
- --Provide all production inputs on timely basis. See Inputs section for recommendations.

--Provide extension education and training to all farmers, including guidance on production, protection, water management, recommended varieties and marketing/storage advice. See recommendations or recent extension review teams.

--Establish linkage with University of Nebraska Sorghum/Millet CRSP to conduct research on sorghum on new lands (Ismailia).

5. Barley

Barley is the least important cereal crop in Egypt in terms of area planted and value. It is a winter crop, generally planted in the more saline soils of the delta and on marginal coastal lands. Rainfed barley in the western coastal desert region is used primarily as food and feed for the bedouins. Barley is universally planted as the first crop on newly reclaimed soils. The crop is plowed under as a green manure crop and helps to improve soil texture and fertility. The bulk of barley produced is a six-row type grain which is used for malting and livestock feed. Barley yields are currently about 2.7 MT/ha and have been in this range since the 1960s. From 1970-1974 barley acreage averaged about 35,000 ha. The average area planted for 1975-79 was 43,800 ha or an increase of 25 percent but the area has decreased again by 11 percent in 1980 and 1981.

Potential for Increased Production

Opportunities for improving yields of barley must be accomplished through the development of improved varieties, tolerant of saline and alkaline growing conditions. The application of better cultural practices is another area where increased yield can be realized. Improved barley varieties which were released by the barley breeding program are shown in Table 16.

From Table 16 it can be seen that in the last twenty years new varieties contributed to a yield increase of 50 percent in 1973

TABLE 16. IMPROVED EGYPTIAN BARLEY VARIETIES.

VARIETY	AREA OF PRODUCTION	AVG. YIELD MT/ha	YEAR OF RELEASE
Baladi 16	Irrigated	2.0	1935
Saharawy	Rainfed	1.2	1955
Bonus	Irrigated	2.3	1956
Giza 117	Irrigated	2.4	1958
Giza 118	Irrigated	2.4	1963
Giza 119	Irrigated	3.6	1973
Giza 121	Irrigated	3.8	to be released

and 5 percent with the 'Giza 121' to be released. Some new promising lines are composite cross 89 and 163 which are six row barleys that exceed the yield of 'Giza 119' by 15 percent in Middle Egypt and 30 percent in Upper Egypt. The new lines also carry improved resistance to leaf rust and powdery mildew, two important diseases of barley in Egypt.

Constraints to Increased Production

--Continued firm support will be necessary for the breeding program after the EMCIP project terminates.

--Availability of improved certified seed to all farmers must be assured.

--Development of high-yielding varieties with aphid resistance, net block resistance etc. is necessary.

--Soil salinity associated with poor water management, excess irrigation and poor drainage.

--Poor cultural practices at farmer level.

--Unavailability of all production inputs on timely basis.

--Lack of effective technology transfer to farmer.

--Mecahnized plot work in varietal and agronomic research.

Recommendations

- --Institutionalize present major cereals improvement project, i.e., "All Egypt Major Cereals Improvement Program." See recommendation under Research and Infrastructures.
- --Introduce germplasm from South Korea to study:
  a. Saline soil tolerance
  b. Wet soil tolerance
  c. Naked barley potential

B. FRUITS

1. Citrus

Citrus, primarily oranges, is by far the major fruit crop enterprise in Egypt. Oranges alone represent 86 percent of total citrus production and 50 percent of total fruit production. Citrus, as well as other tree crops are permanent crops and thus are not part of a year-to-year crop rotation. Interplanting of citrus with other crops is commonly practiced, though the water requirements of each are conflicting, often leading to decreased citrus yields due to excess moisture.

The SAAD background study paper[1] states that: "The major orange types are the Navel and Valencia varieties." Orange production has tripled since the mid-1960s.

Production expanded from an average 320,000 tons in the early 1960s to an average 900,000 tons in 1980 and 1981, (about 140,000 are produced for export). Acreage expanded from an average 71,000 feddans in the early 1960s to 162,000 feddans. Yields have increased in the last decade and currently average about 5.9 tons per feddan (including bearing and non-bearing area). Yield improvement is due to the expanded use of fertilizer and pesticides, and a larger number of bearing trees.

Mandarins. Mandarins are the second major citrus crop in terms of production and acreage. Annual mandarin production is in the range of 75,000-95,000 tons. Area planted has grown marginally in the last decade and was 16,000 feddans in 1980.

Limes. Limes are third in importance among citrus crops. Approximately 17,000 feddans are planted to lime trees, although almost half of these trees are non-bearing. Lime production ranges

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[1] Egyptian Agriculture: a background paper prepared for the SAAD Study. 1982. pp. VII-26.

between 63,000 and 75,000 tons annually, approximately 500 tons of which are exported.

Other citrus. Other citrus output includes grapefruit, lemons, sour oranges, and large limes. Recent annual average production is, respectively, 1,560 tons, 900 tons, 850 tons, and 1,000 tons. Grapefruit production increased about three-fold during the last decade, while production of the other three fruits remained relatively constant.

The price of native oranges has soared as demand for them increased at many shops where oranges are crushed for juice while customers wait. Most of the new orchards were planted with the Valencia variety.

Several thousand acres of oranges will be added to Egypt's resource when the remainder of Sinai is returned. The orange groves between El Arish and Rafah have an average yield of over 9 tons per feddan, compared with 5.5 tons for all orchards harvested by Egyptians in 1981.

About 20,000 feddans of new orange groves are planned in the Salhia project near Ismailia. Constraints concerning prices, marketing and establishing new orchards tend to cloud prospects for expanding private orchards.

Middlemen reportedly get 14 piastres per kilo for oranges after paying 8 piastres per kilo to the grower. A price of $80 per ton for orchards yielding 6 tons would be only $480 per feddan. However, many small growers and their families are able to spend the time to market most of their crop at the retail level for 35 piastres per kilo. This would boost their receipts to over $2,000 per feddan.

Production of oranges in Egypt reached a peak of 1.05 million tons in 1979, but declined to only 895,000 tons in 1981. At the same time demand among urban Egyptians soared and this was reflected in open market prices which doubled in three years. Exports of oranges by El Nadi Company, a public sector company, declined from a peak of 247,000 tons in 1973 to about 135,000 tons in 1981. Domestic demand has increased so much that few oranges from private orchards were exported recently.

Orchards developed on desert land in the desert are often owned by the government. Oranges from Tahrir allow Egypt to export oranges at prices which are still attractive in trade agreements. The Soviet Union has been the leading market for Egypt's exports of oranges. Saudi Arabia recently emerged as a major market. Most of the expansion in the 1960s in orange groves was originally planned for the export market. Soaring domestic demand caught planners by surprise.

The price ceiling of 35 piastres per kilo is now a problem for growers. If higher prices were allowed, more new orchards would be planted. Farmers in the Delta must get a permit to plant orange trees. The slow pace of desert land reclamation limited the expansion in area devoted for oranges in the 1970s. The area planted in oranges was 162,000 feddans in 1981. Beheira, Tahrir and Qalubia are the leading producers or oranges, followed by Sharkia and Menoufia.

Potential for Increased Production

There are no experimental data at present to demonstrate the yield potential of citrus orchards in Egypt. Work is under way to identify the major elements which may be involved in improving citrus production, but that data is not available yet.

The average yield of oranges per hectare, Table 8, is 13.5 MT/ha. Dr. A. H. Krezdorn, University of Florida, Citrus Advisor to the California A.D.S. Horticulture subproject, indicates that there are individual family orcahrds in Egypt which are producing 47.6 MT/ha of navel oranges from 15-year-old orchards. That level of productivity is on a par with well-managed citrus groves in Florida. This would also indicate that there is a potential of increasing productivity in Egypt by 252 percent if production constraints in Egypt are definitely identified and overcome. Dr. A. H. Krezdorn in his TDY report after an October-November visit to Egypt in 1981 identified several factors which may be responsible for low yields, including:

--Weeds--Excessive growth complicates irrigation, drainage, and other management procedures in citrus groves.

--Water management--Both excessive use of water and inadequate drainage systems are problems in most orchards. In the Nubaria area, tests have shown that only 3,000 m^3/feddan of water is required in the newly reclaimed soils there. In that area it is a common practice to use up to 10,000 m^3/feddan of water or more.

--Congested orchards--Pruning is not widely practiced. The small size of plantings in Egypt should make this practice particularly attractive. Probably the major reason for this is that there is no horticultural extension education to teach farmers good management practice within their orchards.

--Excessive fertilization--With subsidized fertilizer, farmers tend to over-fertilize. This can both harm the trees as well as increase total costs of production.

--Diseases--Diseases are a factor that will influence good routine management as the technique for increasing yields. With diseases in the picture, it may be impossible to obtain maximum potential productivity. The major diseases are psurosis virus, stubborn disease (mycoplasma) and tristeza virus.

Psorosis can be eliminated by gradually replanting with psorosis-free trees and stubborn disease can be brought under control through pruning and removal of infected trees. Tristeza can be controlled through use of resistant root stocks, which are available, but that would be only for new trees.

There should be great opportunities to increase citrus production by horizontal expansion in the newly reclaimed lands. In these areas it will require the culture of high value crops such as citrus and vegetables to recapture the high costs of reclamation.

From Table 9, an increase of 1.285 million metric tons of citrus is possible from current producing groves.

Major constraints to Increased Production

--Citrus grove management.

a. Pruning
b. Water management
c. Disease control
d. Excessive fertilizer prices
e. Weeds

--Nursery management.

a. Disease-free nursery stock (viruses and stubborn disease)
b. Nematode-free nursery stock
c. Plant material with potential for high yield and quality--much the same

--Availability of improved varieties of trees.

--Management technology transfer to farmers from extension.

--Diseases.

a. Psorosis virus which does not express itself, except in 15-to 20-year-old trees. Infected trees will decline in production, though some tolerate this disease.

b. Stubborn disease (a mycoplasma)--yields are reduced. Infected trees must be removed and destroyed. All infection takes place before 4 years of age. Infected parts of trees can be pruned off.

c. Tristeza virus infects some orange root stock and thus can infect most Egyptian fruit. This virus can cause decline and death of trees.

--Production credit.

Recommendations

- --Develop and teach management practices for farmers.
- --Strengthen extension service through crash programs to develop extension horticulturists trained in citrus production management so that growers have confidence in them.
- --Eliminate price constraints.
- --Establish Nursery Accreditation guidelines to assure sales and distribution of disease- and nematode-free tree stock with high yield potential.
- --Establish an "All Egypt Citrus Improvement Program" (Interdisciplinary Research and Development Team) from various research institutes. Individual institutes would release scientists to work the program full time or whatever proportion was deemed adequate by the program leader and his advisory committee. This would serve to institutionalize the work under the California project after termination.
- --Upgrade all research facilities and equip them appropriately.
- --Institute research facility management guidelines that are operated and managed by research staff. This includes permanent allocation of land assigned to the program.
- --Provide adequate credit resources to farmers for production credit needs.

C. VEGETABLES

1. Tomatoes

Tomatoes, the most important crop in Egypt, have become major in terms of acreage planted, output and value since the early fifties (Table 8). In 1950 there were 26,000 hectares of tomatoes, 57,000 in 1960, 100,000 in 1970 and 147,000 hectares in 1980. That represents a growth factor of 107 percent in the fifties, 75 percent in the sixties and 43 percent in the seventies. Tomatoes now are grown on about 3 percent of Egypt's total planted area. Tomatoes are grown throughout the old lands in all three seasons, winter, summer, and fall. Tomatoes are grown primarily for domestic use and appear on the market throughout the year with the lowest supply being available in March, April and May. The supply is low during this period because of poor to zero blossom set in January and February. This is due to low temperatures. The ADS-Horticulture project is screening diverse germplasm in a search for cold tolerance. It is only a matter of time before this is accomplished and incorporated into a new cold tolerant variety.

Yield, kg/ha, has increased by 14 percent since 1970. This increase has been primarily due to new varieties. The present national average yield is 17.9 MT/ha. The major market is for fresh tomatoes; however, greater demand is being made by processors for a steady supply of tomatoes for tomato paste production for domestic use and for export.

Tomato losses have been high due to tomato leaf curl virus, early and late blight, and nematodes. The introduction of new cultivars is gradually eliminating these constraints. Two hundred fifty varieties have been evaluated in seven locations. From this set seven new varieties for processing and seven new varieties for the fresh market have been identified. The only disease problem for which there is no known source of resistance is the tomato

leaf curl virus. Some California varieties have morphological and growth characteristics which can help avoid serious damage from the disease. If tomato seedlings are protected from white fly (the vector to TLCV) in the seedling nurseries, the virus-free plants can be set out. The California varieties flower and set fruit very early. So, those varieties set fruit and produce a load of tomatoes and avoid the virus problem during its reproduction stage.

Potential production increases can best be practically assessed by the extension activities of the tomato project. They have developed a set of cultural management practices, when combined with improved cultivars, increased yields are obtained. The current national average for tomato production is 17.9 MT/ha. The average across all demonstration locations was 64 MT/ha. On one 33.6 ha demonstration trial, the project extension tomato activity obtained a yield of 100 MT/ha. They will expand this demonstration to 336 hectares in 1982 during the period from transplanting on March 8 to harvest in May-June. Another 252 hectares will be grown during the Nili season. By the end of 1982 the project hopes to have 10 percent of the tomato area in each governorate planted to new varieties.

In Table 9, it is estimated that a potential average yield of 60.4 MT/ha is a reasonable expectation. Using this assumption, then a net increase of 6.589 million tons of tomatoes could be expected if the transfer of technology was available to farmers.

Constraints to Increased Production

--Adequate seed production system will be needed after California/ ADS/Horticulture project terminates.

--Lack of effective technology transfer system.

--Inputs need to be available in timely manner.

--Institutional research structure is needed to adequately address problems of production, processing and marketing.

Recommendations

- --Train tomato extension subject-matter specialists to cover all governorates where tomatoes are grown.
- --Establish "All Egypt Tomato Production Research Project."

2. Onions

Onions are cultivated in the winter, summer and fall. Winter onion, generally grown in upper and middle Egypt is the mian crop and the source of all fresh exports because of its earliness, pungency, and good keeping quality. Summer onions are generally grown in the Delta region and Giza Governorate. This crop is mainly used for domestic consumption. The fall or nili crop is a much smaller crop. It is also produced for domestic consumption. The area devoted to this crop has gradually expanded over the years. At one time onions were the third most important agricultural export crop. However, with the high dam was completed, and year-round irrigation water was available, the area devoted to onions dropped by 64 percent. This was due in great part because of the dramatic increases in yield per hectare. In 1964 yields averaged 1 MT/ha and in 1965, 28.8 MT/ha. In 1976 yields plummeted from 28.7 MT/ha down to 11.5 MT/ha. This was due to white rot disease caused by Schlerotium cepivorum. The high water table caused by excessive irrigation and poor drainage was an ideal environment for the development of the disease. Thus onion production was driven out of the traditional sandy soil areas to which it was so well adapted to heavier soils, where onions had never been grown before. This was only a temporary solution as the organism flourishes and develops a high inoculum level shortly after onions are introduced into a newer area. Once soils become infested, the disease remains viable for up to 12 years.

Total tonnage produced over the years has stayed fairly constant, ranging from 525,000 MT in 1970 up to 654,000 MT in 1981. The production was 568,000 MT in 1980, and there was a severe shortfall of available onions for the domestic market. Fresh onions at the retail level were reported to have sold as high as LE 1/kg during that period.

An additional problem associated with growing onions in heavier soils is that the farmers must irrigate before harvesting, so the bulbs can be pulled. This causes outer skin slippage, which contributes to early physiological deterioration of the bulb, which contributes to great post-harvest losses. Entire shipments have been lost due to this condition.

Potentials for increasing onion production on the old lands is very limited, unless some method is discovered to control the white rot disease. Other possibilities are for introduction of onion culture into some sandy loam areas in the newly reclaimed lands. The feasibility of this is unknown, as all Nile River water used for irrigation probably carries enough of the Schlerotia inoculum from the white rot disease to cause the same problem in the new soils over time. Research should be initiated to determine this, however. If the white rot disease problem can be solved there is great potential for increasing production. Where average yields range around 11.3 MT/ha today, the potential is 47.6 MT/ha.

Constraints to Increased Production

--Ineffective control of white rot disease, *Schlerotium cepivorum*.

--Need for development of improved cultural practices to help in escape from soil disease problems.

--Improvement in technology transfer for introduction of new cultural management practices is needed.

--Lack of direct-seeding capability. Direct-seeded onions mature onions earlier than transplanted ones. Earlier maturing onions might escape "white rot" infestation.

--New varieties adaptable to direct-seeding should be developed. The present variety 'Giza 6' is unsuitable for direct-seeding practices.

--Labor shortage. Onion production has been diminished as a result of labor shortages during the transplanting period.

--Development of new varieties with improved storage qualities is desirable.

Recommendations

- --Investigate the potential of onion production on newly reclaimed sandy loam soils.
- --Give consideration to transferring onion section to Horticulture Institute and develop subproject in onions under the California/ ADS/Horticulture activities to strengthen the research on this commodity.
- --Investigate integrated pest management practices for control of white rot, i.e., biological control of the organism.
- --Allocation of funds to support work on direct-seeding of onions in Egypt.

3. Garlic

Garlic is a winter cash crop grown in solid stands as well as being intercropped with other winter commodities. Since 1970, total garlic production almost quadrupled, going from 52,000 MT up to 199,111 MT in 1980. The 1981 garlic crop dropped 19 percent, falling to 161,906 MT. The decrease was in large part due to a reduction in area planted. In 1981 about 94,449 MT were produced from 4,998 hectares of single cropped garlic. The average yield

was 18.9 MT/ha. The 1981 intercropped garlic crop amounted to about 67,407 MT from 5,204 hectares. The average yield was 12.9 MT/ha.

The bulk of the garlic crop is consumed domestically. Some garlic is exported. In 1981 fresh garlic exports amounted to about 9,226 MT (fresh weight equivalent) of dehydrated material. The major markets are Italy and the U.S.

While average yields have averaged about 18.3 MT/ha (Table 8) over the last 10 years, average yields in California are 71.4 MT/ha. Mites are a major problem in garlic production and a virus is the major disease. These two problems are the major cause of lower yield values in Egypt. The University of California/ADS/ Horticulture project has demonstrated an increase in yield potential by 70 percent simply by using new practices of controlling mites by dippling garlic cloves in water. Through tissue culture they can produce virus free garlic cloves. It is also estimated that an additional increment in yield potential can be realized by controlling weeds and other pests. The California project received LE 45,000 in 1982 so that extension could demonstrate this potential to farmers in upper Egypt. That budget will provide for extension meetngs, demonstration trials, inputs for farmers to try the new practices, transport and incentives for the extension workers.

Constraints to Increased Production

--Need for improved varieties that are high-yielding with pest and disease resistance.

--Inadequate technology transfer--Lack of an effective extension service is the major constraint to educating all garlic growers about new production techniques and disease and pest control. This is a major problem.

--Improved cultural practices are needed with regard to optimum plant density, fertilization, weed control, insect control and planting dates.

--Lack of screen houses to maintain and to increase new virus-free garlic planting stock constrains production. The ADS Horticulture project has these on order.

Recommendations

- --Implement recommendations of recent Agricultural Extension Review and Assessment Team.
- --Institutionalize improved garlic breeding and development program under the California/ADS/Horticulture project.

4. Potatoes

In terms of cash value and total tonnage produced, potatoes rank second only to tomatoes in the vegetable category. In terms of exports, however, potatoes rank first among the vegetable crops. They are grown in three seasons -- spring, fall and winter. The spring crop, planted in December and January is harvested in May and June. This crop depends almost entirely on imported seed. This crop provides seed for the fall crop, fulfills the export requirements for summer demand, and also the demand for local consumption during the summer. The fall crop, produced from seed stored for the months of July and August, is planted during August-September. It is harvested in December to January. This crop is primarily for export. The winter crop is also grown for export and for domestic consumption.

No improved varieties have been developed for Egypt. The entire crop is generated from imported varieties each year. The primary constraint to local seed production is the lack of cold storage. Predominant storage at the local level is ventilated mud brick huts and straw heaps. Seed losses can go up to 20-30 percent or

higher in this type of storage. The major disease problems have been potato viruses (can cause 10 percent losses) and the potato tuber moth. The latter not only causes economic physical damage to tubers but results in primary sites for secondary invasion of storage fungi. Since 1960 potato hectarage has increased around 200 percent (23,000 hectares up to 64,000 in 1981). During the same time average yield increased from 12.6 MT/ha up to 18.1 MT/ha in 1981.

Opportunities for increased potato production again are great. With "on shelf" technology, demonstration yields have been shown to be 47.6 MT/ha as opposed to the national average of 18 MT/ha.

The opportunity of realization again primarily depends on:

--an effective technical information transfer system to the farmer,
--timely availability of inputs,
--improved water management education to farmers and
--availability of improved seed.

Egypt is trying to move toward an effective domestic breeding and certified seed production program. Planting material to date has depended on European germplasm and varieties, which have been remarkably well adapted. If the domestic initiative moves forward, then effective linkage for utilization of information, germplasm, and research training opportunities with the International Potato Center, Lima, Peru, (CIP) should be established.

Major Constraints to Increased Production

--Indifferent technology transfer system.

--Unavailability of timely inputs.

--Pests and diseases.

--Lack of effective research program to fine-tune adaptation of potato varieties to Egyptian environmental conditions.

--Lack of cost storage facilities to cover maintenance of seed requirements, especially during the summer months.

Recommendations

- --Train extension subject-matter specialists to cover all gov norates where potatoes are grown.
- --Establish linkages with CIP for all areas of training in potato production and utilization.
- --Establish Interdisciplinary Research Team to assure collaboration between potato agronomists, breeders, entomologists and pathologists.
- --Establish linkages with CIP for germplasm introduction and collaboration in potato-breeding research.
- --Expand cold storage facilities for storage of seed potatoes.

D. FORAGE CROPS

According to A. W. Mostafa and A. Rammah, Egyptian clover, *Trifolium alexandrinum* L. (berseem), is the major winter forage crop cultivated in the Nile Valley and the Nile Delta. Berseem is the dominant winter forage crop from which most of the farm animals are fed. It contributes about 98 percent of the value of all forage crops. The tight cropping pattern in the Nile Valley and Delta does not allow growing of other forage crops. Egyptian clover or berseem ranks first among other field crops with respect to its area, being some 1.176 million hectares of which

--546.1 thousand hectares are grown as a catch crop of temporary clover from which one or two cuttings are taken before planting cotton.

--630.1 thousand hectares as full term clover yielding 3-4 cuts of about 25-28 tons/feddan of green fodder.

Approximately 10 to 15 percent of the full-term area of clover is left after the last cutting for seed setting. Seed yield varies from 238-595 kg/ha over the various locations and from one season to another.

In the summer after the last berseem harvest, there is an acute deficit of green fodder. The area planted with summer forage crops does not exceed 29.4 thousand hectares because of the severe competition with other cash and food crops. This is the main reason for the great reduction of food stuffs (green fodder) during the summer season.

In newly reclaimed lands cultivation of alfalfa (Medicago sativa) has been taken up on a large scale (84.0 thousand hectares) throughout the year. In addition to its good quality forage, it is grown as a means of soil-building and improvement.

The quantities of green fodder produced from sown forage crops and roughages from crop residues are given in Table 17. Animal feed requirements of farm animals are shown in Table 18, which, when compared with total value of feeds, shows an annual deficit of 1.5 million tons of starch value. Much of this deficit is evident during the summer because of the unbalanced nature of feed supplies. The total acreage of summer forages is very limited at present, due to the economic competition from summer cash crops. One way to reduce summer feed deficits is to increase per unit area increase in productivity of berseem, so as to be able to produce a surplus to be used as hay in the summer. The other plausible approach would be for farmers to plant 1/10 of their maize hectarage to an improved forage sorghum. Theoretically this could amount to 71.4 thousand hectares with a potential production of 71.4 MT/ha of green fodder. This would amount to a total increased production of 50.98 million MT of green forage with a total increased starch value of 5.6 million MT.

TABLE 17. QUANTITY OF AVAILABLE GREEN FODDER AND ROUGHAGES AND THEIR NUTRITIVE VALUE IN EGYPT.

Feed Stuff	Quantity 000 Tons	Nutritive Value			
		Starch Value		Digestible Protein	
		%	000 Ton	%	000 Ton
Berseem	48802000	8	3904160	2	976050
Alfalfa	504000	8	40320	3	15120
Other green forage	667841	11	73463	1.5	10018
SUBTOTAL	50273841		4047943		1005688
Hay	324700	35	113695		24353
Straw	3808600	23	875978	0.1	3809
Rice Straw	5000000	21	1200000	0.6	26000
SUBTOTAL	9133300		2189623		54162
TOTAL CONCENTRATES			1071764		201726

TABLE 18. ANNUAL FEED REQUIREMENTS OF FARM ANIMALS IN EGYPT.

SPECIES		Starch Equivalent (SV) 000	Digestible Protein (DP) 000
Buffaloes & Cows	4314	5689	781
Sheep & Goats	3227	468	89
Camels	101	240	37
Horses	1528	1424	152
Pigs	15	15	2
TOTAL	9125	7836	1061

Source: A. W. Mostafa and A. Rammah, New Research Programs Incorporation into EMCIP.

There is no program for the production of certified forage seed in Egypt. Berseem seed is mostly produced and used on the farm. Surplus seed is sold to private dealers who do not care about variety or quality, resulting in considerable seed adulteration and low quality.

Future farm needs for production of berseem seed are expected to drop when good quality seed is supplied through a seed certification plan, whereas future needs from other forage crops is based on the projected expansion in their acreage in the new lands and in the Delta when seed supplies become more available.

In addition to berseem, other forages grown as winter crops are Vetch (Vicia sativa) and funugreek (Trigonella foenum-graecum). About 16.8 to 29.4 thousand hectares of other summer forage crops produced are thickly planted maize, sweet sorghum (Sorghum vulgare var. Saccharatum), sudan grass (Sorghum sudanense), pearl millet (Pennisetum americanum), and cowpea (Vigna unguiculata subsp. sesquipedalis). About 84 thousand feddans of perennial alfalfa and napier grass are produced in reclaimed areas outside the Nile Valley.

In summary, the major two ways to increase yields of forages and especially summer forage requirements are:

--increase productivity of berseem, and

--allocate land during summer for high-yielding sorghum type grasses.

Major Constraints to Increased Production

--Lack of effective forage improvement program (breeding, physiology etc.).

--Lack of adequate laboratory and research facilities.

--Lack of coordination between different plant science disciplines, as well as animal science disciplines (no interdisciplinary research teams).

--No transportation for the research staff of the forage program in the Field Crop Research Institute.

--Lack of enough trained scientists to conduct forage/livestock research.

Recommendations

- --Establish an "All Egypt Forage/Livestock Interdisciplinary Team" for development of improved forages for Egypt. Institutionalize the EMCIP forage activity.
- --Develop linkages with the International Livestock Center (ILCA) and cooperate with their forage program.
- --Develop a training program for forage/livestock research programs.
- --Work with the maize/extension program for forage grass promotion.

E. FOOD LEGUMES

Food legumes include a number of bean crops that are used for human consumption. They are in order of importance: (1) faba beans (Vicia faba), (2) lentils (Lens culinaris), (3) fenugreek (Trigonella foenum-graecum) and (4) soybeans (Glycine max). With the exception of soybeans all of the food legumes are grown as winter crops. Faba beans and lentils have declined considerably in recent years. The annual production of faba beans and lentils falls below the national needs for consumption with the deficit made up through imports. Faba bean acreage has fallen 40 percent from the high levels of the 1960s. About 15 percent of the losses are experienced with broad beans because of weed competition, disease chocolate spot caused by Botrytis fabre, rust caused by Uromyces faba and brown rape which is a parasitic weed of Oronbanche genus. Waterlogged soils also continue to be a problem. Faba beans are not the safest crop for a farmer to grow.

Faba beans are consumed both as a green and a dry bean. Beans sown in October or November may be harvested entirely as green beans

(if prices are good) or allowed to mature in the field. Though acreage of faba beans has been falling, average yields have been going up. The average yield per hectare in 1961-70 was 1.96 MT/ha; in 1971-80 it increased to 2.3 MT/ha,and in 1981 it was 2.4 MT/ha. The area for green faba bean production has remained fairly constant at about 16.1 thousand hectares per year. Some initiative should be given to improving this aspect of the crop.

Lentils are also a winter crop grown mostly in Upper Egypt, and production has declined in recent years. Average production is only about 1.1 MT/ha, and this is not very competitive with other winter crops such as berseem or wheat. Acreage of lentils declined from about 32,000 hectares in the 1960s down to 6.300 hectares in the 1980s. Yields also have been declining. This is attributed to waterlogged soils in traditional growing areas.

Soybeans have been supported well by the government, and acreage has grown from 252 hectares in 1966 to 1,386 in 1970 and up to 37,807 by 1981. Yields have been increasing with an average yield of 2.67 tons per hectare in 1981. Soybeans are grown as a summer crop. Yields tend to decrease as planting is delayed after April 15. This is the optimum planting date for avoiding cotton leaf worm infestations. In later plantings more applications of insecticides are required. The demand for soybeans comes from two directions: (1) the soybean oil is a desirable cooking oil, and (2) the soybean meal by-product is an excellent source of protein for poultry feed.

Opportunities for improving yields for grain legumes are never as great or dramatic as with cereal grains. Yield increases come more gradually and slowly.

There has been an ICARDA/IFAD Nile Valley project on faba beans which has been conducting studies on farm level constraints to high yields in Minia and Kafr El-Sheikh provinces in 1980/81. They have

found that by using a package of practices of improved plant population and correct fertilizer levels, they were able to obtain 0.22 to .80 MT/ha increase in seed yield. The breeding program underway at present within the Field Crop Research Institute is well-organized and in a few years should have new varieties which will be much higher yielding and resistant to major diseases and pest problems.

The opportunities for increases in soybean yields are even greater. As illustrated by Table 4, U.S. irrigated soybean yields are 3.4 MT/ha and the maximums are 6.1 MT/ha compared to Egypt's yields of 2.4 MT/ha. As the soybean program continues and research develops new varieties which are fully adapted to the local environment, then there is no reason why average soybean yields should not continue to increase. The estimated potential in this report is 2.7 MT/ha within the range of current varieties.

Potential for lentil increases are very modest, moving from 1.1 MT/ha to 1.5 MT/ha. Probably because of the competitive advantage of almost all other crops, lentils will either stay at the present level or continue to decline. There does not appear to be much opportunity for growing increased amounts of lentils in Egypt.

Major Constraints to Increased Lentil Production

--Faba bean varieties need more yield-stability as well as disease and *Orobanche* resistance.

--Lentils are sensitive to waterlogged soils.

--Cotton leaf worm and red mite resistant soybean varieties that are also adapted to late May planting are required.

--Lack of technical transfer system.

--Low controlled prices for faba beans and lentils.

Recommendations

- --Continue to cooperate with ICARDA/IFAD on faba beans and lentils.
- --Continue to cooperate with INTSOY on soybeans.
- --Establish contact with the International Institute for Tropical Agriculture (IITA), Nigeria for obtaining soybean germplasm for testing of a promiscuous nodulation character in Egypt.
- --Establish extension subject-matter specialist positions for the grain legumes.
- --Continue to develop breeding and agronomic programs which will develop more genetic material specifically adapted to the environmental conditions of Egypt.

F. SUGAR CROPS

1. Sugarcane

Sugarcane has become increasingly important in Egyptian agriculture over the last 20 years. Egypt's sugar trade had fluctuated with net imports one year and net exports the next. However, recently Egypt's imports have grown steadily climbing to an estimated 686,000 tons in 1981. Sugarcane is the main field crop in the two southernmost governorates of Upper Egypt where more than one-half of the sugarcane is grown (this includes the Aswan area). Some sugarcane is grown in Middle Egypt. About 85-90 percent of the cane is used for sugar extraction and the remaining for fresh consumption or for making molasses.

The sugarcane area has almost doubled since 1965, growing from 60,000 hectares in 1965 to 105,000 hectares in 1980-82. During the same period, average yields have declined from 92.2 Mt/ha in 1965 to 82.1 MT/ha in 1981-82. Probably the three major causes of decreasing yields are: (1) waterlogged soils, (2) expansion into marginal soils and (3) ratoon stunt disease which causes 10-15 percent yield loss.

Sugarcane is normally planted in January and February. It is recommended that farmers take only two successive ratoon crops. Both the Field Crop Institute and the Sugar Institute have been investigating intercropping another crop with the first planting. They have found that if a farmer follows instructions, he can intercrop berseem, wheat, maize, sorghum, soybeans, vegetables or sunflowers. For example, it is possible to obtain 143 MT of sugar per hectare and an additional 3.2 MT of wheat per hectare. This sort of research should continue because potentially one-third of 105,000 hectares should be available annually for intercropping.

All varieties of sugarcane grown in Egypt have been introduced. This is because the environmental conditions in Egypt were not satisfactory for the initiation of flowering and seed setting of cane. However, recently they were able to induce flowering on cane in the Mediterranean area. The problem is sterile seeds. Egypt needs greenhouses for breeding and disease-control research. There is also a lack of breeding material. They could use 200 to 300 new introductions per year. Many organizations in sugar-growing areas are now selling improved varieties for as much as $10,000 each. This forces Egypt to depend almost entirely on a public breeding program and germplasm as their source of new material.

A prime constraint to maximizing production of sugarcane is the ratoon stunting disease. This disease can be controlled by hot water treatment of vegetative pieces. A stunt elimination program is difficult to launch because of lack of equipment.

The potential for increasing sugar production is very great. Where average yields are about 80.9 MT/ha, yields of 166 MT (or more than <u>double</u>) are within reasonable expectations.

Major Constraints to Increased Sugar Production

--Waterlogged soils.

--Inadequate breeding program.

--Lack of germplasm

--Lack of trained sugarcane scientists.

--Lack of research facilities, greenhouses and screen houses etc.

--Need for soil amelioration program. It was estimated that 25 percent of cane soils are saline--others are alkaline.

--Labor shortage for weeding.

--Mechanization for subsoiling, planting, harvesting, leveling and loading.

--Inadequate technologe transfer. Lack of trained Extension Service people to teach farmers good practices for intercropping and how to get maximum yields.

Recommendations

- --See Natural Resources Report on recommendations on waterlogged soils, salinity and alkalinity.
- --Strengthen breeding program (facilities and training of staff to do a better job).
- --Continue research on intercropping.
- --Train and appoint sugarcane extension subject-matter specialists so that the extension bottleneck can be resolved.
- --Search for ways to increase introduction of new germplasm.

G. FIBER CROPS

1. Cotton

Cotton has traditionally been the single most important crop in

Egypt. Cotton fiber is the leading agricultural export crop and contributes much of the raw fiber required in domestic textile manufacturing. The importance of cotton to Egypt's economy is paramount. It is estimated that 50 percent of the industrial sector is involved in the textile industry which is based primarily in cotton. This may amount to 1,000,000 workers and their families. Overall in Egypt there may be 6,000,000 people involved in cotton production and utilization. Cotton seed supplies about 90 percent of domestically produced edible vegetable oils; this comprises only about 100,000 MT of the present oil requirements, and this figure is in turn only about 22 percent of the estimated domestic oil consumption of 458,000 MT. Cotton acreage has fallen over 25 percent from its high levels in the 1950s-60s, yet yield improvements have prevented total production from declining. Egypt at present grows only long-staple cotton, namely varieties of Gossypium barbadense. Recently there has been a shift away from the extra-long-staple (over 1 3/8") cotton. Due to the switch to shorter, more productive staple-types, plus concentration on the most fertile lands, good weather conditions and improved pest control, yields/unit area were the highest ever in Egypt. The average yield in 1980-81 was 0.426 MT/feddan (Table 2).

There are greater yield opportunities if Egypt were to switch to upland cotton, Gossypium hirsutum for domestic use, and reserve the long-staple cotton for export.

In contrast to other crops grown in Egypt, high quality seed is produced for planting the crop. By law, the production of seed for planting is controlled rigorously by the Seed Production Department. The Cotton Research Institute is responsible for production of breeder seed through certified seed. The integrity of this program is maintained by the system of ginning only one variety of cotton through any given cotton gin. This prevents varietal mixing. There is also a system of premium payments to

growers for the best quality seed, financed through the Egyptian Cotton Improvement fund by a tax on all ginned cotton.

The opportunity to increase the production percentage in this area by the Cotton Research Institute is not great. According to the institute there is little expectation for increase; from the data in Table 4, it can be seen that the average yield for Gossypium barbadense in Arizona is about the same as in Egyptian--921 kg/ha. Maximum yields for the Egyptian cotton in Arizona is 1.8 MT of lint per hectare. The average yield for upland cotton, Gossypium hirsutum in California is 1.5 MT/ha and the maximum is 2.5 MT/ha. This would indicate that there may be some opportunity for increasing average yields in cotton here in Egypt if an aggressive breeding and development program is continued or expanded.

In reference to cotton there is another concern which should be considered. In order to control all insect pests of cotton fully, it is necessary to follow very stringent control programs which generally is done by aerial spraying. Pest control is very cost-intensive in cotton production. Because cotton is a fiber crop, regulations regarding insecticide tolerances on seed are much less stringent than on food crops. Because cotton spray programs are done by helicopter in Egypt, some consideration should be given to insecticide drift and the effect on the livestock and human population. There was a March 30, 1982 editorial in the English language Egyptian Gazette about this very subject.

There are areas which sould be developed congruent with cotton. In order to reduce expense of production, no-till production practices should be investigated. Intercropping with cotton is practiced widely in Egypt. Onions for example are widely intercropped; however, onions are common hosts for thrips, and thrips are a pest of cotton. These kinds of relationships should be studied. Also, where food crops are intercropped with cotton,

what kind of pesticide residues that may be potentially toxic to humans may be entering the food chain? Faba beans are commonly the winter crop preceding cotton. However, because cotton needs to be planted no later than March 31st in order to avoid the pink bollworn infestation in August/September, attention should be given to mechanized soil preparation between harvest of faba beans and planting of cotton. Often only 7-10 days of turnaround time is available between the crops.

Though the opportunity may be great for increasing production per unit area from short-staple cotton, there are some problems associated with this that the Cotton Research Institute identified. The main problem is maintaining the purity of Egyptian long-staple lines; this purity is critical to the spinners and weavers who import the very fine grades of long-staple cotton. The farmers themselves are moving the upland cotton to Egyptian cotton areas because they like the size of the boll of upland cotton. The farmer believes this might result in larger yields, but that is not necessarily true because upland cotton has fewer bolls per plant than Egyptian cotton.

If there were one distinct advantage of upland cotton, it would be the maturity cycle. Egyptian cotton requires 120-130 days from planting to maturity whereas upland cotton only requires about 85 days from planting to maturity. That extra 35-45 days would allow another cutting of berseem where berseem precedes cotton in the planting rotation. This is a benefit that truly needs to be taken into consideration.

Constraints to Increased Production

--Egyptian variety has reached a yield plateau.

--Problem of mixing Egyptian long-staple cotton with shorter staple upland cotton, to where this becomes a constraint to promoting the higher yielding upland material for domestic use.

--Mechanization is needed for field preparation after faba bean and before cotton planting by March 31.

--Pest control.

Recommendations

- --Strengthen varietal development and breeding.
- --Investigate ways for mechanizing the land preparation and planting of cotton after a winter crop.
- --Investigate opportunities for growing the shorter season vegetable crop or an additional cutting of berseem to the cropping pattern.

IV. CONCLUDING OBSERVATIONS

There is a level of "shelf technology" ready for use in almost every crop which will increase yields by 50 percent or greater. In a sense, both the farmers and the scientists are constrained from producing at optimum levels because of current government policies and practices. The scientist cannot function because he does not have the facilities or resources to carry out the kind of job necessary to stay ahead in dynamic agricultural research. The farmer cannot function because he receives low prices for his product and does not receive the benefit from government institutions which will help him to produce at a maximum potential.

There is a lack of effective credit, Extension Service, input delivery and other needs that keep the farmers operating at the marginal level. There is a wealth of trained human resources in Egypt that can produce if given the opportunity to be rewarded for their efforts. At all field stations, it appeared that agricultural research laboratories were to a great extent in a state of disuse and very poorly equipped. Locations where projects were operating are exceptions. It seems as if the researcher under the present system is at the mercy of the system rather than working with the system to produce research results. These constraints will have to be removed before any of the great potential for increases in agricultural production can be achieved.

EGYPT: STRATEGIES FOR ACCELERATIN
AGRICULTURAL DEVELOPMENT

ANNEX G

ANIMAL PRODUCTION

By

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ANNEX G: ANIMAL PRODUCTION

SUMMARY

Experimental evidence indicates that the potential exists for doubling production of most classes of Egyptian livestock.

The possibility of increased biological potential could be promising, if dedicated, well-educated scientists who are provided with high quality facilities and sustained budgetary support are appropriately encouraged. The many constraints retarding the actual achievement of biological potentials are discussed.

Financial and production success within the poultry industry demonstrates the successful mobilization of research, management, and technology to the development of a new industry in Egypt. Assistance from the U.S. has been important in this achievement. Further expansion seems promising and spin-off will stimulate other sectors of livestock and fish production. New research on the hydrolyzation of straw seems highly promising.

Some advantages inherent in the currently profitable livestock industry are relatively free market prices, rising incomes and abundant grain imports at low prices to farmers. However, many small farmers must seek employment off the farm. The farm wife, isolated as a result of social custom, is overlooked, despite her important role in livestock production. Many opportunities listed herein for livestock improvement pertain to aspects of farm life for which women are responsible.

I. CONTEMPORARY EGYPTIAN ANIMAL PRODUCTION AND CIRCUMSTANCES WHICH MAY INFLUENCE ITS FUTURE DEVELOPMENT

Domestic animals in Egypt supply meat, milk, eggs, wool, hides and manure and are valued as draft animals.

The population of grazing animals in the Nile Valley of Egypt historically has been one of the densest in the world--about one animal unit (cow equivalent) per feddan. In addition, the region has been important for poultry and fish. The Egyptian diet is rich and varied, and even the poorest benefit from the country's food largesse. The government has always been concerned with food and fiber production, and some of its scientific agricultural institutions were established almost a century ago.

While livestock statistics are commonly accepted to be more subjective than other data from the agricultural sector, evidence indicates that practically all livestock production is growing at a fairly rapid rate (Table 1.). Indirectly this is substantiated by the fairly constant per capita increase in consumption of animal protein in the Egyptian population. This situation obviously would not be possible if there were not a growing supply of available livestock.

The second indirect evidence of increasing livestock population relates to increased imports of feed grain and expanded amounts of land devoted to growing berseem (*Trifolium Alexandinum*, Egyptian or Alexandrian clover), (Buchanan et al., 1982).

Relative to major field crops, berseem, which is used solely for livestock feeding, is the most profitable for the farmer. As Ingram and Morsi (1981) have indicated (Table 2), net returns to the farmer per feddan are much higher if berseem is in the cropping program. It has been argued that the profit picture relative to berseem is exaggerated because supplies of wheat and feedgrains available to Egypt under various

TABLE 1 ESTIMATED LIVESTOCK NUMBERS (Fitch and Soliman, 1981).

	CATTLE	BUFFALO	SHEEP	GOATS	CAMELS	PIGS	DONKEYS
	000						
1960	1,867	1,781	2.220	1,588	154	22	1,012
1970	2,115	2,009	2,066	1,155	127	15	1,362
1978	2,589	2,512	2,554	1,440	43	15	NA
	average annual rate of growth (percent)						
1960-70	1.3	1.2	- .7	-3.1	-3.6	-3.8	3.0
1970-78	2.5	3.0	2.7	2.8	-3.8	NA	NA

TABLE 2. RETURNS FROM CROP COMBINATIONS (Ingram and Morse, 1981).

	NET REVENUE TO FARMER	NET REVENUE TO ECONOMY
	LE/feddan	
Berseem/rice	260.5	415
Berseem/maize	255.4	256
Sugarcane	129.0	533
Soybeans/maize	127.0	109
Broadbeans/maize	119.0	92
Berseem/cotton	112.0	471
Onions/maize	97.0	882
Wheat/rice	88.0	294
Wheat/maize	83.0	134

donor programs are below world prices. However, the above authors also point out that even calculating berseem and other commodities at international feed values, the clover remains a high-revenue crop relative to many alternatives. A major reason for a thriving livestock industry in Egypt rests on the availability of this high quality forage which covers more land area than any other single crop.

Another major reason for the growth of the livestock industry, particularly poultry, lies in the increasing availability of imported feed grains and their distribution to Egyptian producers at about one-third of world prices. The remarkable increase in the production of poultry meat and eggs is directly dependent upon the increased importation of feed grains under various discretionary programs. The development of specialized dairy and meat production systems also are directly related to the increased gain supply.

GRAZING ANIMALS

Considering all buffalo, cattle, camels, donkeys, horses, goats and sheep, there are almost five-and-one-half million animal units (one cow equals one unit) of grazing animals in Egypt. This concentration of approximately one animal unit per feddan (Hopkins, 1980) approximates that of many countries. More than two-thirds of this population is made up of cattle and buffalo; about 10 percent are sheep and goats; an equal percent are donkeys and horses. As will be pointed out, this population was more or less in balance with Egyptian feed production through the 60's and early 70's. Native cattle were used primarily for work with secondary emphasis on milk and meat. This contrast, with the situation in India where oxen, not cows, have been used for work with the result that Egyptian farmers have saved quantities of feed compared to India. In addition, the value of milk has led to the slaughter of male calves for veal. This decreases meat supply but saves feed. Sheep and goats have their own ecological niche and provide wook, meat and milk. They exist largely as scavengers.

Into this balanced system have come recent important changes, imported feed grains sold at highly subsidized prices have encouraged milk production through the dry summer season; previously this was not feasible. Likewise, these imported feed grains have enabled the raising of male calves for fattening and the production of more mature beef relative to veal production. Given the relatively free market for meat and milk and the availability of low-priced concentrates, farmers have profited from increasing the area of land under berseem and perhaps from increasing the fertilization of berseem.

Another powerful force relative to changes in livestock population is the low cost of tractor fuel, fuel for pumps and other machinery that reduces the dependency on animal power.

According to the human nutritional goals cited by the Chase Information Corporation (1982), over one-third of the meat and dairy products consumed in Egypt were imported. If production goals are to be achieved by the year 2000, the country must increase production of meat by 250 percent, milk by 160 percent, and eggs by 300 percent.

Consumption of red meat actually increased by 50 percent between 1972 and 1980. Dairy product consumption increased 85 percent. Almost 40 percent of Egyptian milk requirements were imported in 1980, largely in the form of powdered milk or processed dairy products.

In 1974, consumption of poultry meat was about 95,000 metric tons (MT); by 1981 it had expanded to 260,000 MT; by 2000 it is likely to reach 700,000 MT. In 1981 155,000 MT of poultry meat were produced locally (less than 60 percent of the requirement). By the year 2000, the government hopes that the local industry will produce at least 660,000 MT, over four times the 1981 production level.

Egypt was virtually self-sufficient in the production of eggs in 1981, but by the end of the century consumption is expected to have

increased from 2.4 billion eggs (1981) to 8.4 billion eggs. About half this total is expected to be produced from commercial companies with the other balance coming from small village flocks.

According to Chase (1982), the Ministry of Agriculture's strategic plan for the animal sector is to increase red meat production by 90 percent by the year 2000 and milk production by 159 percent by improving the productivity of existing small herds. The plan entails the development of government programs aimed at treating sterility and parasites and at the genetic upgrading of herds through artificial insemination using imported semen. The government also hopes to encourage private feed lot operations. Rather than slaughtering male buffalo and cattle at about 70 kilos for veal, the government goal is to encourage feed-lot operations so that buffalo are raised to about 500 kilos prior to slaughter. This should result in increases of nearly 75,000 MT per year. Other projects are also to be encouraged and assisted through private cooperatives, organized around approximately 400 larger livestock and dairy farmers and which will operate under the auspices of the General Cooperative for Developing Animal Wealth and Products.

Close to four billion dollars were spent by Egyptians for four million metric tons of animal products in 1981--over 35 percent of which was imported. Caloric and protein intake by the average Egyptian is above the minimum requirement. However, animal protein represents a small percentage of the Egyptian diet, probably about 15-25 percent of the total protein consumed. As per capita income increases, animal protein will be increasingly in demand.

California scientists (Bywater et al., 1981) in conjunction with Egyptian scientists reported on the development of animal production in Egypt. It complements the paper by the Chase group (1982). Although the objectives of the various teams differed slightly, all placed great stress on the difficulties engendered by the fact that 90 percent of the annual herd is dispersed among small holders (two to five animals): this

makes the extension of nutritional, management, breeding, and health management infomation to producers extremely difficult. Nevertheless, they did consider that opportunities for improvement based upon current knowledge clearly exist. The Egyptian animal production committee has suggested as an appropriate and attainable goal the provision of 18 grams of animal protein per day to a population of 70 million people in the year 2000 (Table 3). Estimated in Table 4 are the numbers of animals needed to produce this much meat. Animal products are recognized to be both highly desired and nutritious. Their high protein/calorie ratio and amino acid complement are important to a balanced nutritional diet.

RUMINANTS, CROP RESIDUES AND FORAGES

Ruminant animals are valued for being able to convert agricultural products not edible by man into edible products, thus adding to the total food supply. Bywater et al. (1980) reported comparisons between different species for California animal agriculture, and these data are given in Table 5. Because dairy cattle consume large amounts of roughage and can use certain protein substitutes not useful to humans, such as urea, there is relatively small overlap or competition for food. For the small amount of overlap that does exist, dairy cattle give an exceptionally high rate of return. In contrast, for poultry a high percentage of the diet consists of foods which could be used directly by humans. As a result, poultry shows the lowest rate of return of competitive energy and protein of all the domestic species used for meat or milk production.

These interrelationships are shown quantitatively in Figures 1 and 2 from the Bywater et al. report. The energy and protein output relative to input of nutrients which could be consumed directly by humans are indicated. Rations which include very low quantities of human edible energy produce very high levels of beef energy for human consumption as indicated to the left of the curves. These conditions entail the raising of beef cattle primarily on pasture and farm roughages with very small amount of concentrates. To the far right (Figure 1) it is illustrated

TABLE 3. CURRENT AND PROJECTED INTAKE OF ANIMAL PRODUCTS[1] (Bywater et al., 1981).

PRODUCT	Current INTAKE/PERSON	Current TOTAL	2000 INTAKE/PERSON	2000 TOTAL
	kg/year	MT 1000	kg/year	MT 1000
Meat[2]	8.0	328.0[2]	7.8	550.0
Poultry	2.7	110.0[3]	6.9	485.0
Fish	3.2	131.0	3.7	260.0
Milk	48.0	1,970.0	64.0	4,500.0
Eggs	1.5	61.5	3.8	270.0
	10 g animal protein/day		18 g animal protein/day	

[1] Derived, in part, from report of an Egyptian Animal Production Committee.

[2] Percentages of meat from cattle, buffalo, sheep, goats, camels, swine are 38.5, 42.5, 11,7, 5.5, 1.5, and 0.3, respectively.

[3] Values do not include imports of 125,000 MT red meat and 25,000 MT poultry meat.

TABLE 4. CURRENT AND PROJECTED PRODUCTION OF MEAT (Bywater et al., 1981).

SPECIES	NUMBERS	CURRENT MEAT PRODUCTION		PROJECTED MEAT PRODUCTION	
		1000 MT	kg/animal yr.	1000 MT	kg/animal yr.[1]
Cattle	2.1×10^6	125	59.5	212	100.8
Buffalo	2.1×10^6	138	65.7	234	111.3
Sheep	2.6×10^6	38	14.6	64	24.8
Goats	1.4×10^6	18	12.8	30	21.8
Camels	9.3×10^4	5	53.8	8	88.7

[1] Total meat production total animal population.

TABLE 5. INPUTS AND RETURNS FROM CALIFORNIA ANIMAL PRODUCTION (Bywater et al., 1981).

	Percentage Return of Human Edible Input	
	Energy	Protein
Milk	101	181
Beef	57	109
Swine	58	86
Poultry	31	75

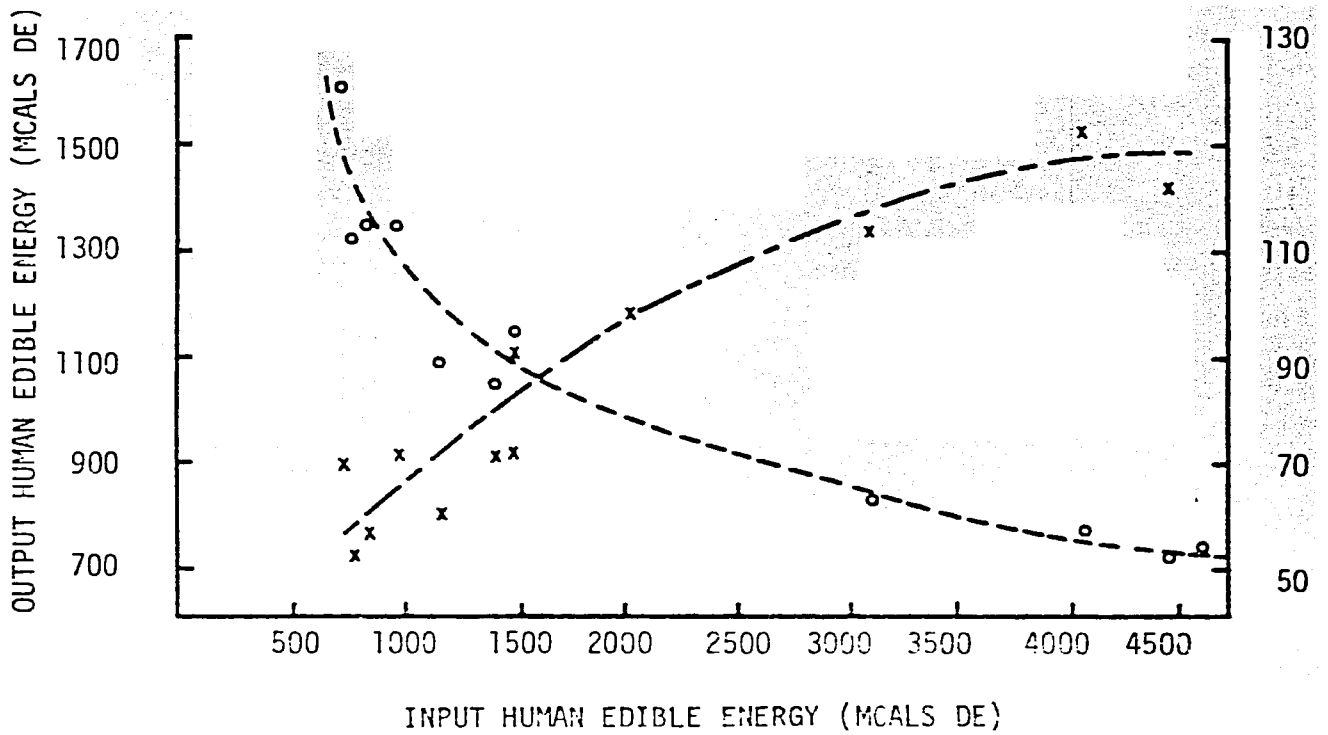

FIGURE 1. ENERGY OUTPUT AND EFFICIENCY OF BEEF PRODUCTION.

Source: Bywater et al., 1981.

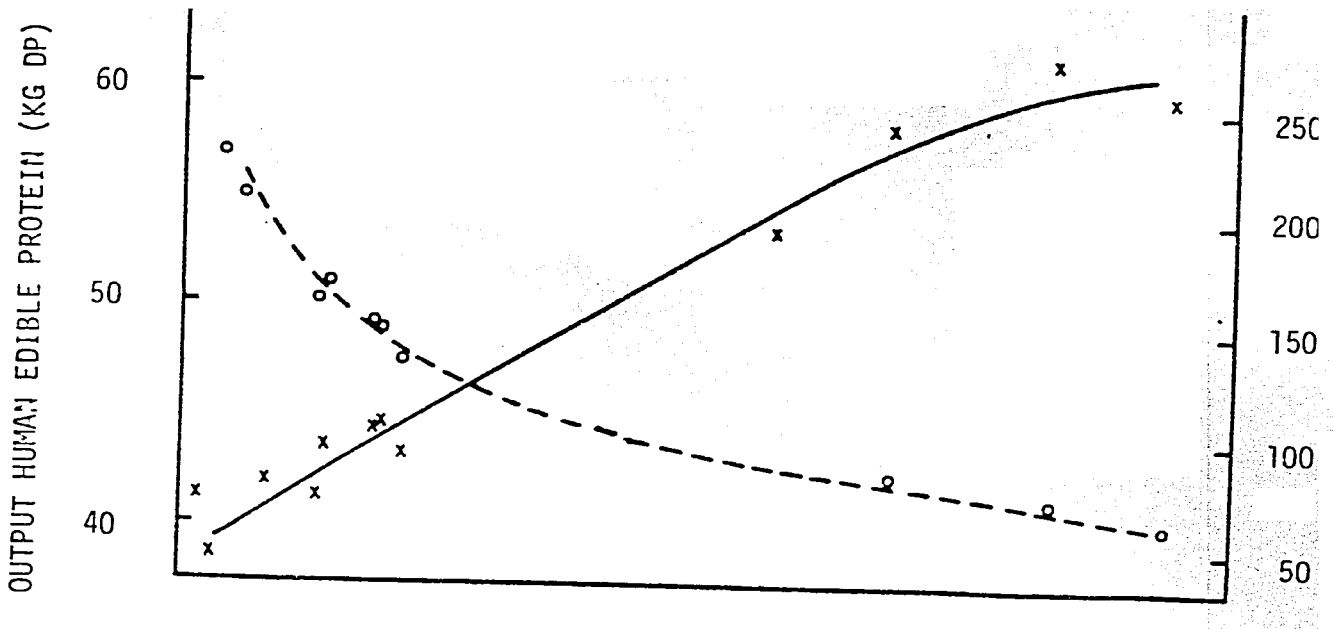

FIGURE 2. PROTEIN OUTPUT AND EFFICIENCY OF BEEF PRODUCTION.

Source: Bywater et al., 1981.

that relatively large amounts of edible energy from the human standpoint produce relatively low amounts of energy from beef. The final stages of finishing cattle with grain would have this relationship. A similar pattern follows for competitive protein intake between humans and cattle. This quantification of net gain in food production obtainable for humans through livestock is highly applicable to the Egyptian situation.

It can be expected that should the time arise when food grain imports are greatly limited, commercial poultry production would be the first to suffer, perhaps to the point of extinction. In this event, milk and meat production from large ruminants would provide about the only local animal products available. Cattle and buffalo would persist because of the high efficiency of the ruminant in increasing total food supply through consumption of berseem, crop residues, improved summer forages and other available grazing.

Rees et al. (1977) estimated availability of the following crop residues: wheat straw, 1,700 MT; barley straw, 90 MT; rice straw, 2,400 MT; maize stover, 5,000 MT; maize cobs, 500 MT; sorghum stover, 1,700 MT; sugarcane tops, 2,000 MT; and cottonseed stalks, 2,500 MT. The ratio of residue to grain for cereal crops is 1:1; corn stover to grain, 2:1; tops to cane, 1:4; and cotton stalks to line, 5:1. Also, there is a possibility of using at least 200,000 MT of alkali-treated bagasse. This would have energy value of not less than two-thirds that of maize. Other fuel would need to be substituted for bagasse in sugar manufacturing, but this is considered to be highly economic.

INTERDEPENDENCE OF CEREAL, BERSEEM AND LIVESTOCK PRODUCTION

Since buffalo and cattle are the predominant livestock of Egypt, trends in their numbers with crop areas and tonnage of cereals produced were examined (Table 6). In 1980 buffalo and cattle numbers were twice as large as in 1950, whereas crop area has increased only 21% in thirty years. The production of buffalo and cattle <u>per feddan</u> of total

TABLE 6. EGYPTIAN POPULATION TRENDS IN CATTLE AND BUFFALO NUMBERS RELATIVE TO AREA OF LAND CULTIVATED, AREAS IN BERSEEM, TONNAGE OF CEREALS PRODUCED.

Year (Nearest)	1000 Animals Cattle	+ Buffalo	= Sum	Year	Total Crop Area	Berseem	Total Cereal Grains	
					(000 feddans)	(000 feddans)	(000 feddans)	MT
1950(52)	1356	1212	2568	1950-54	9412	2148	1694	3673
1960	1588	1524	3112	1960-64	10389	2362	1926	4994
1970	2115	2009	4124	1970-74	10855	2444	1911	6618
1980(78)	2587	2542	5129	1979-80	11422	2801	1979	7373

Adapted from El Togby, 1976; Buchanan et al., 1982.

crops has increased dramatically and steadily during these thirty years to the point that density per feddan is 1.7 times what it was in 1950. The concentration of buffalo and cattle per feddan of berseem has increased by a value of 1.55 (Table 7). This probably indicates that production of berseem per feddan has increased although no precise data on this are available.

Production of buffalo and cattle relative to feddans of cereal straw (A/D) has increased even more markedly with a ratio of 1.7 times that of 1950. Since weight of cereal straw per feddan is expected to increase on about a one-to-one basis with increased tonnage of grain, we would expect straw and crop residue tonnage to double as has cereal grain tonnage. The ratio of buffalo and cattle numbers to total cereal grains is the same as in 1950, which would be expected if buffalo and cattle numbers keep in balance with cereal straw produced.

The Egyptian farmer has not customarily burned crop residues, not even rice straw, as is routinely done in the Philippines. Farmers are accustomed to feeding some rice straw (el Oksh et al., 1978). With two to three crops per year, straw ploughed into the soil would lower the production of the succeeding crop. Thus, getting some fodder value from straw is advantageous; likewise, more livestock can be maintained when straw increases.

Donovan (1977) reported that in 1970 crop residues and by-products provided only 24 percent of the energy and 13 percent of the protein feed resources available to livestock. Beyond this he said that most livestock feeds in Egypt are grown in competition with crops which could be used directly for human consumption. If 1.6 million feddans planted to full season berseem were planted to winter wheat yielding 1.4 tons per feddan, and refined into wheat flour, 5.9 billion megacalories and 197,000 tons of crude protein would be provided. Further, 1.2 million feddans currently in short season berseem could be sown to other crops such as vegetables or pulses which could be consumed and which would not

TABLE 7. INCREASE RELATIVE TO 1950: IN CATTLE AND BUFFALO (A); TOTAL CROP AREA (B); A/B; A/B BASE 1950; AREA OF BERSEEM (C); A/C; A/C BASE 1950; TOTAL AREA IN CEREAL GRAINS (D); A/D; A/D BASE 1950; TOTAL CEREAL GRAINS PRODUCED IN METRIC TONS (E); A/E; A/E BASE 1950.

DATA NEAREST YEAR	A	B	A/B	Base '50 A/B	C	A/C	Base '50 A/C	D	A/D	Base '50 A/D	E	A/E	Base '50 A/E
1950	1.00	1.00	0.27	1.00	1.00	1.18	1.00	1.00	1.52	1.00	1.00	0.70	1.00
1960	1.21	1.10	0.30	1.11	1.08	1.32	1.12	1.14	1.62	1.06	1.36	0.62	0.89
1970	1.61	1.15	0.38	1.41	1.12	1.69	1.43	1.13	2.16	1.42	1.80	0.62	0.89
1980	2.00	1.21	0.46	1.70	1.28	1.83	1.55	1.17	2.59	1.70	2.01	0.70	1.00

From El Togby, Buchanan et al., 1982.

directly upset subsequent crop rotations. The meat and milk, excluding poultry, produced in 1967 provided about 1.9 billion megacalories and 105,000 tons of crude protein.

The deeply established Egyptian practice of returning crop residues to the soil through animal manures undoubtedly affects livestock numbers, density and berseem production.

WORK ANIMALS

Estimates shows that little more than two-thirds of animal power available is used for irrigation pumping and only about 30 percent is used for other purposes. The medium-term future course for the livestock subsector is likely to be characterized by stabilization in animal numbers; this would mean an overall reduction in that machines will be replacing draft animals as farmers become satisfied that machines are reliably available. Tractors have, in some parts of the world, induced owners to resume direct operation of their farms, displacing tenants. Mechanization may increase yields through improved and more timely operations, may expand off-farm employment opportunities and may intensify some on-farm operations, such as livestock enterprises, particularly dairying. If machines were substituted for animal draft, the same area of berseem could produce more food of animal origin, perhaps twice as much as at present.

According to FAO/World Bank (1976) about two million cattle and buffalo were used for turning sakias (water wheels for water lifting). This duty alone requires about 72 percent of the total animal hours spent on farm work. It is estimated that even at the present level of nutrition, release of animals from farm work would increase their milk yield by 33 percent and meat production by 65 percent. These data on meat and milk production, however, do not appear to be substantiated by other evidence. Winrock (1980) found that buffalo used for water pumping gave 770 kg of milk; whereas those not used gave 14 percent

more or 900 kg. For cattle, those used at the sakia gave 490 kg whereas those not worked gave less--450 kg.

A comparison of Berger's (1977) estimate on lifting water with animal power and this writer's personal estimate based on interviews, particularly relative to milk loss and calf loss, is presented in Table 8. Cost per feddan was approximately 4 times as great in the Berger report on animal power as that computed by Stonaker (1978). More precise research is needed in general; while these results may have applied in 1978, the increase in mechanical water pumping as of this time has been considerable. This is due in part to the availability of small-capacity pumps and to low-cost fuel. In 1978 it was estimated that in the trend toward mechanization, operation of sakias would be the last farming operation in which animal power would be replaced by motorized equipment.

There appears to have been little research done in Egypt on the development of more efficient animal-drawn farm equipment. In some countries, such as India and Brazil, very large increases in efficiency of output have been made possible through the improvement of animal-powered machinery.

The use of mechanization on 17 Zagazig farms (El Oksh and Stonaker, 1978) showed considerable parallelism to other reports. Eighty-two percent did all of their plowing with tractors, 18 percent had mechanical pumps for water raising, 29 percent used tractors or trucks for transport, and all of them used a mechanical thresher. Estimations of milk reduction resulting from six hours of work was from 10 to 100 percent. Most were of the opinion that it took two to three days rest before milk production was restored. Most farmers worked their cows and buffalo cows, and when asked what their livestock plans were for the future, very few were going to decrease, while most were going to maintain or increase their livestock numbers. In August most cattle and buffalo were considered to be in good condition with most calving taking place between November and January during the berseem period.

TABLE 8. VARIOUS METHODS OF CALCULATING SAKIA COSTS USING COWS FOR POWER.

Assuming 3 cows to irrigate 15 feddans:

	Stonaker			Berger
	Cow Rental LE	Cost Calculation LE	LE	Cow Power
a) Cow rented for 50 pt/2 hr shift 25 pt/hr LE 1.5/day 495 cows days vs	742.5[illegible]			
d) (360 cow days)	(540.[illegible]			
Milk loss 3 cows	--	18.00	18.00	297.00
Calf loss	--	0	0	100.00
b) Depreciation on cows	--	0	0	39.50
b) Depreciation on water wheel	44.90	44.90	44.90	44.90
Death loss on cows 5%	--	52.50	52.50	--
b) Maintenance of wheel	10.00	10.00	10.00	10.00
Extra feed supplements 495 days work	--	45.51	[c]59.40	[b]247.50
d) 360 days work		(33.12)	(43.20)	
Annual Costs for 15 feddans	797.40	170.94	184.80	738.90
d)	(594.90)	(158.52)	(168.60)	
Cost for each feddan	53.16	11.40	12.32	49.26
d)	(40.02)	(10.57)	(11.24)	

Explanations:

a) Zagazig area 8/78 some situations reported by Dr. Hassan El Oksh in survey of cows rented for sakia work at LE 50/2 hr shifts (it is assumed this included driver).
b) Berger calculations, 495 cow days for 15 feddans.
c) Stonaker calculations, 4 kg concentrate/day @ .023 LE/kg (government price) vs .03 LE/kg (open market) for 495 working days/15 feddans. Maintenance costs not included would be charged to calf milk and manure values.
d) Using 24 animal days/feddan/yr.

Special note: There is a large discrepancy between Berger data used here on working days for water lifting = 33 cow days. Data furnished by Wade Jones indicate only 24 animal days for feddan/yr.

The effect of work on cattle and buffalo also depends upon the distribution of this work relative to freshening and relative to the availability of berseem. As is noted in Figure 3, the heaviest work period falls at the end of the berseem period and also at the end of the lactation period. Thus, since lactating animals were at the end of the lactation period little total milk loss was experienced.

REPRODUCTION, DEATH LOSS AND EXTRACTION RATE

As will be seen later in the discussion on health, low fertility rates and high death losses of calves, particularly buffalo are commonly reported. Winrock (1980) estimates are shown in Table 9.

Indirectly these may be inferred from the extraction rate, which is the number slaughtered relative to the number of animals in the population. Ranges in extraction rates for cattle through the world vary from 10 to 11 percent in tropical savannas of South American and Africa to 25 percent in Australia versus rates of 40 percent in the U.S.A. At 10 percent, the weaning rate is 40-50 percent, and the national herd cannot increase itself. At weaning rates approaching 80 percent an extraction or annual slaughter rate of about 40 percent is possible. With Egyptian cattle at 29 percent and buffalo at 34 percent performance is far above the savannas but much below the U.S. (Table 10).

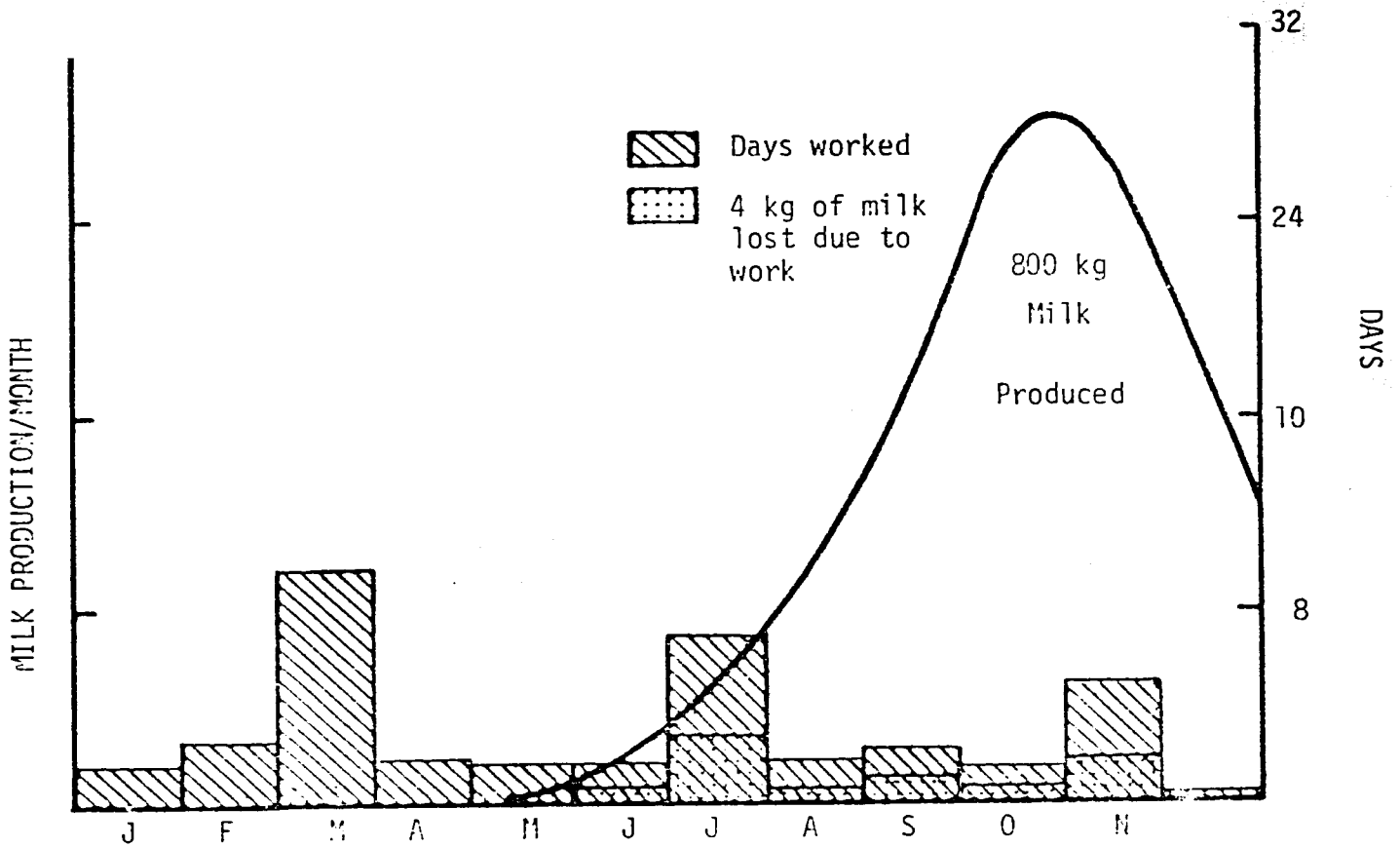

FIGURE 3. IDEALIZED VERSION OF LACTATION CURVE AND WORK LOAD OF NATIVE CATTLE IN EGUPT AS IT MAY AFFECT MILK PRODUCTION.

TABLE 9. REPRODUCTIVE PERFORMANCE AND MORTALITY RATES IN TWO VILLAGES (Winrock, 1980).

	Musha (Upper Egypt)		ZGEK (Lower Egypt)	
	Buffalo	Native Cattle	Buffalo	Native Cattle
Age in months first calving	36-47	36-47	48-59	49-57
Calving intervals in months	15	13	19	17
Birthrate %	70-80	70-80	40-50	50-60
Calf mortality %				
0 - 1 month	15	10	15	10
0 - 2 months	18	12	18	12
0 - 6 months	21	15	21	15
0 -12 months	25	18	25	18
12 -24 months	4	4	4	4

TABLE 10. EXTRACTION RATE AS RELATED TO NUMBERS SLAUGHTERED.

LIVESTOCK	1978[1] POPULATION	TOTAL HEAD SLAUGHTERED	EXTRACTION RATE (%)	HEAD SLAUGHTERED IN OFFICIAL ABATTOIRS	HEAD SLAUGHTERED BY LOCAL BUTCHERS
Cattle	2,587,000	750,000	29	530,000	220,000
Buffalo	2,542,000	875,000	34	451,000	424,000
Sheep	2,554,000	1,490,000	58	432,000	1,058,000
Goats	1,440,000	1,000,000	69	24,000	976,000

Source: "Egypt: Livestock and By-Product Report," U.S. Embassy, Cairo, October 1980.

[1] CAPMAS, Ref. No. 71-12412/79 (Fitch and Soliman, 1981).

II. ANIMAL PRODUCTION POTENTIALS

Experimental results indicate that in practically all species of farm animals a doubling of production or a doubling of efficiency is currently attainable. However, maximum yields of production are not the most economically sound levels of production and thus serve only to indicate what can be done if biological constraints are removed.

POULTRY POTENTIALS

Within Egypt at the present time the production efficiency of small farms is enormously different from that of modern commercial operations with the gap in efficiency rapidly widening.

The annual rate of increase in broiler production under confinement recently has been at the rate of 11 percent per year. This is important as the plan is to shift the availability of high quality animal protein from four kg per year *per capita* to 12 kg.

By 1980 poultry meat production had doubled from the 1960-64 level. Not only are the remarkable increases in production noteworthy, but poultry production in Egypt is interesting because three fairly distinct systems of production co-exist--traditional village, commercial, and government. The commercial system largely parallels that followed by the government poultry organization. They will be compared with the village production system. About half the poultry meat and 10 percent of the table eggs are produced by the General Poultry Company of the Egyptian government and by private sector companies. The private sector, which produces about the same amount of poultry meat as the General Poultry Company, is considered to be performing with a higher level of efficiency (Sayed, 1982). It appears that the advanced technology available in Europe and the United States in poultry production is in practice in Egypt on a broad basis. Feed conversion rates and egg production in commercial flocks are said to be approximately equal to those

in western countries. With advantages of subsidized feed grains and a relatively open pricing policy on eggs and poultry meat, the management in EGYPCO (1982) estimates that the expanding production of broiler meat will continue for several years, depending largely on the government's policies relative to imported feed grains. The almost unanimous opinion among producers is that broiler production is still profitable and poultry production is necessary to produce profit on farms.

For normal broiler production not fewer than 5000 birds are managed at a given time; for layers the number found on a given farm may be between 10 and 100 thousand. The hatcheries, mostly new, have very modern imported equipment and technology. Non-farmers as well as farmers have entered the commercial poultry business. The highly specialized training necessary for managing these operation is in Egyptian hands, although European and U.S. companies have provided extensive hands-on training in preparing workers for the various skilled jobs and management necessary if operations are to be successful. Parent stock to be used in breeding hybrid broiler chicks are imported primarily from England (EGYPTCO interview). Many other critical inputs for poultry production also are imported, including vaccines and nutritional ingredients. Most feed grains are imported through the Ministry of Supply. Competition within the private sector appears healthy, with several companies and producers of all sizes competing actively.

Some Egyptian poultry producers aspire to become the broiler meat and egg provisioners for their Arab neighbors. They have the advantages of climate, location, high technology and training that could make this possible. An important key to the situation is the ability to maintain open communication and access to world poultry technology and inputs. The spinoff effects of success in the poultry industry may be even more meaningful to Egyptian agriculture than the direct effect of production. The apparent advantages in terms of scale of operation, high technology and keen competition from other western countries make it important to Egyptians to demonstrate their capabilities and exploit their special

resources in a fiercely competitive world market. It should be noted, however, that Saudi Arabia and other countries also have ambitions in this direction. Lebanon has long experience in the high-technology-commercial-poultry-production business.

The EGYPCO Poultry Company (1982) is a privately financed corporation with approximately 8,000 stockholders; it reported a 20 percent return on investment during 1981. The preparation of feed concentrates primarily for broiler production is from grains imported through the Ministry of Agriculture. Soybean products are imported directly through Central Soya in the United States. Farmers buying broiler chicks and marketing through EGYPCO require about 45 days to produce a three-kilogram bird. Concentrate for poultry costs approximately LE 150 to LE 200 per ton, in contrast to LE 37 for cattle feed. These are subsidized prices. Maize on the open market sells for LE 150 per ton whereas the government price is LE 60 per ton. While it is expected that poultry meat production will continue to expand, it is difficult to predict the future pattern other than to say that assuming feed grains are available in large amounts, it will increase. The Egyptians have amply demonstrated their ability to rapidly adapt the most advanced technology to successful meat production, indicating their talents for innovation, management, and production. In the case of the commercial poultry sector there appears to have been very little dependence on government assistance.

The MOA through the Institute for Animal Production Research is breeding birds especially adapted to village conditions. These have the capability of doubling production over native hens. Concerted government efforts and village veterinary services are needed to support the village poultry industry. Overall, the potential for increased production in village flocks is enormous.

THE FISHING INDUSTRY

Current estimates of fish production in Egypt range between 120,000 MT/yr and 200,000 MT/yr, broken down as follows: Mediterranean, 15,000 MT/ Red Sea 18,000 MT; Northern Lakes, 73,000 MT, with the remainder coming from Lake Nasser.[1] Official prices for tilapia is LE 1.0/kg and for mullet LE 2.0/kg, whereas on the open market their values are LE 2.2 and LE 6.0/kg, respectively. If current projects are successfully completed, fish production could be increased many times over present levels. Potentially some of the largest fish farm projects in the world are being financed largely through USAID and the World Bank.

The High Dam has had a large effect on the biology of the Nile River, decreasing the catch below the dam. Yet the 350 x 10 km Lake Nasser, for a number of reasons, has yielded a smaller catch of fish than had been anticipated. It is estimated at 30,000 tons of fish/yr, but with improvements in equipment and methodology this is predicted to increase to 100,000 tons/yr. A contract has been made with the Egyptian Fishing Company to improve fish management in Lake Nasser with the assistance of the Japanese government.[2] The procedure will be to fence off estuaries of the river and put them under intensive fish management procedures. The Lake Nasser Yield can be improved also through better technology for deep fishing. Currently, most fishing is done along the shoreline. In Lake Nasser the fishing is under the High Dam Authority, not under the Ministry of Agriculture. The fish from Lake Nasser are processed at the lake into frozen fish fillets, with waste products going into livestock feed and fertilizers.

For the past three years aquaculture projects have been administered by the Ministry of Agriculture. Five thousand feddans of fishponds are being built at Abassa for production under both public and private sectors.

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[1] Interview with

[2] Interview with

Ten feddans of land will be sold to college graduates and other qualified persons for the establishment of fish ponds. The Maryout Fish Pond near Alexandria is establishing another 3,000-feddan fish pond project. In this case five-and-a-half feddans will be sold to graduates for the establishment of fish ponds. The projects underway are the El-Riswia fish farm near Port Said consisting of 1,000 feddans, 600 of which have been in production since 1981. This is managed by the public sector. The Behair Governorate has 2,000 feddans under construction for the Birsik Fish Farm. Private fish farmers may get technical assistance, but they must be licensed by the Ministry of Agriculture. Species being used are primarily carp and mullet with some experimentation with tilapia. There is not a good estimate at this time as to the anticipated production of these new fish farms, but under well-managed conditions, yields of 300 kg fish/yr/feddan are anticipated. In Italy and Spain, by contrast, between 30 and 100 tons of fish have been produced/yr/feddan. It is anticipated that yields of one to two tons/yr/feddan could be expected in the near future on these fish farms. This potential is several times the present production

RUMINANT ANIMALS POTENTIALS

An exciting research project in its early stages is the MOA-UNDP project at Nubaria on the hydrolyzation of straw through the use of ammonia gas. As indicated earlier, between four and eight million tons of crop residue are produced annually in Egypt. In addition, wastes are accumulated at cotton gins in the form of cotton seed hulls and at rice-cleaning plants in the form of rice hulls. This refuse has considerable energy value, although in untreated form it is of little use to livestock.

Among the more interesting possibilities researched at Nubaria by the UNDP team and their Egyptian counterparts is a project on fumigating stacks of crop residues with ammonia under plastic cover. These are adaptations of research by Klopfenstein of the University of Nebraska.

Feeding ammoniated rice straw to buffalo resulted in 10 percent greater intake and daily gain increases of .4 kg, in comparison with no gain from the non-treated straw. The current economics of ammoniating straw are negative due to the pricing of imported feed grains--maize is at LE 60/MT, in comparison with about LE 170/MT on an international market basis at Alexandria. Thus high prices of berseem and straw largely depend upon anticipation of cheap prices of maize. Some straw must be used in the ration to provide roughage. Because of the large amount of grain available at low cost, straw has its principal value as necessary roughage to maintain ruminant activity. For example, wheat straw has a value of LE 100/MT; increasing the digestibility of straw with ammonia treatment gives a negative financial effect. Large users of baled straw can anticipate that the treatment would cost LE 10/MT of straw processed. This is with a 3 percent by weight application of ammonia. In contrast, the small user, because of the increased cost of plastic and distribution costs on the ammonia, has a total cost of LE 17.5/MT in contrast with the LE 10/MT for large producers.

In the absence of large imports of maize at subsidized prices, it seems reasonable that Egypt could have millions of tons of improved roughage for its ruminant livestock available at relatively favorable prices. Although the process can be applied on small farms, it appear that the current use of the system would be economically sound only where large producers are replacing berseem with treated straw.

Dr. Michael Creek has pointed out that through ammoniazation, straw may be satisfactorily hydrolyzed to form higher grade roughages on which ruminants can gain rather than just maintain or lose weight. He summarizes the effect as one kg of ammonia NH_3 used to treat straw can produce one kg of liveweight, substituting for six kg of unified feed concentrate.

Squires (1982) has indicated that production of livestock other than poultry was in balance with Egyptian feed supplies from about 1960

through the 1970's. In recent years, however, production has expanded as feed supply has increased. Some pressures for change have been increased mechanization to relieve or replace draft animals and imports of maize (currently over a million tons annually) with subsuquent concessionary sale to livestock producers. Increased live cattle imports from Ireland by the Meat and Milk Supply Board may aggravate the feed deficit when imported as feeder cattle for finishing in Egypt.

As in poultry and dairying, there exist wide differences in the efficiency of feed conversion. For example, on the meat and milk company farm in Nubaria, by feeding a complete balanced ration, the conversion rate is 8 to 10 kg of grain to one kg of gain. In villages, as many as 16 kg of feed will yield only one kg of gain. In creating balanced feeding rations, use of molasses and treatment of local roughages such as wheat and rice straw with ammonia have been increased. These have the advantage of being locally produced. There seems to be, in line with the current policy in developing greater food security in Egypt, a logical reason for decreasing exports of molasses and including more of it in the locally produced livestock rations. Dr. Hattout[1] estimates that these new techniques in Egypt could lead to using the locally produced molasses supply completely within five years.

In summary, this illustrated how a tremendous increase in quality and usefulness of available food supplies for ruminant livestock may come through the modification and improvement of an old technology. Its impact on Egypt's program for food security seems most promising.

POTENTIALS IN BUFFALO BREEDING

It appears likely that low cost engine fuel and increased use of motors and engines in agriculture will diminish the demand for animal power. Should this trend continue, there will almost certainly be an opportunity to change the cattle and buffalo population genetically

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[1] Animal Production Research Institute, Cairo.

from poor milking animals that do well at work, to animals that are more efficient as milk and meat producers. Greater increases in buffalo numbers relative to native cattle indicate some current movement in this direction, the buffalo being the more desirable milk animal. Projects are being planned to improve the buffalo following the strategy that led to successful dairy cattle breeding. This involves artificial insemination and progeny testing so that better dairy buffalo bulls can be used on farms. International cooperation projects with Pakistan-provided frozen semen and some cross-bred milking strains of buffaloes are now underway at Sakha. The results will be of great importance. However, selection as a source of genetic improvement is slow and information on buffalo does not approach a level comparable to that which has enabled the remarkable improvement in the Holstein-Friesian breed of cattle in the United States during the last thirty years. It does appear that the trend toward more milking buffalo and fewer work cattle may continue through the next two decades. This provides a certain amount of security relative to farm power as the water buffalo also is a satisfactory work animal, although less adapted to farm work than native cattle. Assuming that research in dairy cattle breeding can be applied to buffalo breeding, genetic increases of 1 to 2 percent/yr could possibly be attained.

Since buffalo can not cross with cattle, it is difficult to quickly expand the population. A potential for doing this is through ova transplantation with the bovine cow as the host mother. This research has been initiated at the University of Florida and will be of interest to Egypt, as well.

POTENTIALS IN DAIRY CATTLE BREEDING

New research (Mostageer, 1981) has expanded greatly the understanding of cross-breeding native with European breeds, including the Friesian. Such crossbreds have been found in specialized dairy herds in Egypt for at least fifty years. Early results reported by a number of workers indicate substantial increases in milk production per lactation from

crossbreds derived from high-grade cattle of European origin, primarily Friesian. Despite the sustained advocacy of these crossbreds by some geneticists, there has appeared very little progress in regard to incorporating milk and meat types of European origin into the native national herd. It is assumed that this is due primarily to the perceived lack of suitability on the part of corssbreds for work. There is currently little reason to think the fellaheen will change to Friesian, unless economic conditions indicate that production will be profitable and that the need for work cattle will be diminished. Work by Mostageer does not consider the capability of the crossbred or grade Friesian as a work animal. However, his recent work has greatly enlarged understanding of the total performance of the characteristics of the native-Friesian first-cross and other European multiple purpose breeds. Reproductive capacity and calving intervals have been reported in addition to milk production per lactation.

The most important aspect of production, according to Mostageer, is the superiority of the crossbred relative to native cattle and high grade Friesian in reproductive performance. Crossbreds approximately equal high grade Friesian in production of milk per lactation. Native cattle calve about a year later than the crossbred or the Friesian. Life-time data for the different breeding groups are not yet available. Through the second lactation crossbreds exceed both Baladi and high grade Friesian. There may be little need to incorporate more than 50 percent exotic genes into native cattle. These results to date parallel those found in other tropical areas of the world where 50 percent Holstein or Friesian with native cattle have given optimum results for dairy production. If lifetime production of these cattle in Egypt continues to parallel results elsewhere, one would expect that milk production over the lifetime of the crossbred cattle may at least double that of native cows as a consequence of the multiplicative effects of earlier age at first calving, higher levels of milk production, and shorter calving intervals. Thus, whatever size national herd may ultimately by justified relative to feed resources, it can be expected that a given amount of

milk may be produced with much fewer cattle than would be expected if only native cattle were to be used. McDowell (1972) has indicated that this may cut the feed requirement by as much as two-thirds in the production of a given quantity of milk. Other interesting aspects of the Mostageer report indicate that the Holstein crosses of the U.S. have exceeded in production and weight per age the Friesian crosses coming from Europe, particularly form the Dutch Friesians. The various crossbreds from European breeds, the Braunvieh or Brown Swiss crosses have been somewhat superior to the Friesian crosses.

Another important opportunity relative to the availability of these experimental cattle would be to utilize them in work experiments so that their relative performance as work cattle could be examined. Unfortunately while many important and expensive decisions have been made concerning the increased production which may be expected from cattle and buffalo if they were not worked, very little work has been scientifically done to give experimental evidence on which to base decisions. The financial stakes of these results are very high.

The meat production characteristics of these various crossbreds generally repeat observations made in other parts of the world. That is, the carcass characteristics are not appreciably different for the various breeding groups. Growth rates tend to follow the pattern of mature size of the breeds in the particular cross. Efficiency of food utilization is expected to more or less reflect the health of the animal as influenced by genotype. That is, healthy, well-adapted animals would be more efficient than poorly adapted animals. It is anticipated that the first-cross native/European breed would perform better than either parent stock.

While buffalo currently is the better animal for milk production, this could change and a preference for crossbred cows could prevail.

SUMMARY

Potential doubling of productivity per animal or product per feddan in livestock, poultry and fish is currently evident. On some commercial and experimental farms these techniques have been demonstrated. However, village suitability should not be inferred. All estimates assume achievement of a reasonable level of disease control.

REASONABLE ESTIMATES OF POTENTIAL
PRODUCTION INCREASES IN EGYPTIAN LIVESTOCK

	Commercial or Experimental Production Relative to Village Production
Broiler Meat	Twice the efficiency, infinite production depending on imported feed grains
Egg Production	Twice the production
Fish Production	Three or more times depending on available feed grains
Cattle Feeding	Twice the efficiency
Crossbred Milk Cows/Native cattle	Two times the production per month of life
Genetic Selection of Buffalo for Milk	One-two percent increase/yr many times over that currently likely
Straw Utilization through Ammoniation	Replacement of 6 kg of concentrate with 1 kg of NH_3; potential cost benefit about five times
Use of New Summer Forages (see Crops) for Summer Feeding	Supply 1/2 feddan in forage sorghum to provide sufficient summer forage for one animal unit; equivalent to 200,000 feddans

III. FACTORS LIMITING ABILITY TO ACHIEVE DEVELOPMENT POTENTIAL ALONG WITH RECOMMENDED ACTIONS

ISSUES IN LIVESTOCK PRODUCTION AND FEED GRAINS

Constraint: Variations in feed supply

Feed supply always is a controlling factor in livestock production under any system. Farmers control animal population numbers and types according to the feed supply which they ordinarily expect to be available. Abrupt changes in feed supply disrupt the evolved pattern in systems of livestock production and may be associated with a period of unusual profits or unusual losses. Increases in berseem production largely have been complemented by the rapid increase in availability of imported feed grains for livestock and poultry. Thus, total feed supply for animals has increased greatly. It can be assumed that if the importation of low cost feed grains continues to increase, the poultry industry will be the first to respond in its expansion, but ruminant livestock also can be expected to increase, particularly dairying. On the other hand, it can be predicted that if the quantity of grains available for livestock feeding drops rapidly, there would first be heavy liquidation in the poultry industry followed by a decrease in intensive milk production, with the least effect perhaps on the sheep and goat population.

Recommendation:

- Government policy should focus on softening shocks to the system by avoiding rapid changed in policies in regard to adjusting levels of imports so that the result is a more efficient, smoother operating livestock, poultry and fish industry. The current policy of importing large amounts of feed grains results in lowered concern for such long term opportunities as increasing the summer feed supply for ruminants. Opportunities to add to local improvement in feed supply seem to be

primarily ammoniation of straws, and the use of high producing forage sorghums and Napier grass. Despite disincentives at this time, research on ammoniation should be expanded, as should forage research.

ISSUE: BERSEEM PRODUCTION RESEARCH

Constraint: Lack of information on berseem

Despite the information that berseem occupies a larger land area for a greater period of time than any other crop and that it returns more per feddan than any other major field crop, a major constraint appears to be research information relative to berseem Few attempts appear to have been made to improve berseem either through cultural or fertilizer practices or through genetic improvement.

Recommendation:

- Berseem deserves much more research attention than it has been receiving. Genetic, fertilization and management improvements have been neglected. Further, examining the potential of berseem to serve as a source of high quality protein concentrate suitable for human and poultry consumption, is important. Attention should be given to the results of research done at the University of Wisconsin with alfalfa. Juice extracts of alfalfa, when coagulated and dried, furnish higher quality protein of greater quantity per hectare than soybeans. This type of research seems applicable in Egypt.

ISSUE: LIVESTOCK BREEDING

Constraint: Work value vs. milk and meat production values

Cattle breeding is largely associated with the trends in farm mechanization. It has been estimated that 90 percent of the cattle

herd is maintained for the production of work and meat with small emphasis on milk. Large differences occur in the efficiency of milk production. Mechanization could replace a considerable number of work cattle in Egypt.

There appears to be, along with a rapid increase in tractors for farmwork in Egypt, an increasing number of small pumps for lifting water from canals. Thus, the shift from animal-powered sakias to irrigation pumps may take place more rapidly than anticipated. This could mean an opportunity for a revolution in cattle breeding in Egypt. However, it seems unlikely that mechanization will soon be developed as highly as in Europe where appreciable numbers of cattle and horses are still worked on farms.

Recommendation:

- Replacement of Baladi cows by rapid importation of European milk cattle would be done at very high cost and with generally unsatisfactory biological and economic results. Unfortunately, this seems to be in vogue.

The more reliable and economic approach would be offering crossbred native cattle/Holsteins or high grade Holstein bulls with some percentage of native genes to villages to replace the native bulls currently being used. In some regions artificial insemination services might be satisfactorily followed if undue increase in calving intervals can be avoided. So far as we know, other than on government farms, no widespread acceptance of artificial insemination exists in the countryside. This is not necessarily an indication of backwardness or reluctance to accept new technology by the farmer, but may reflect the difficulty of heat detection in single cow herds, problems in distribution of semen, or villagers' lack of acceptance of the Freisian. Practical operational problems at the farm level deserve consideration.

ISSUE: IMPROVED DESIGN OF ANIMAL-POWERED EQUIPMENT

Constraint: Lowered efficiency of animal work possibly due to poorly designed equipment.

While there has been some improvement in the sakia, most farm operations involving animal draft power depend upon plows and other implements that have been used for centuries. These implements in some cases may be only half as efficient as they could be.

Recommendation:

- Many sources of improved tillage implements for draft oxen are available with much higher levels of efficiency of output than those currently used in Egypt. Brazil and India have been particularly advanced in the application of better ox-drawn equipment.

- Importation should be made of improved ox-drawn equipment from various countries. Tests should be made of these under Egyptian conditions (Parker, 1977). It seems unlikely that motorized equipment will rapidly replace the work cattle of Egypt.

ISSUE: SHIFTING FROM WORK TO MEAT AND MILK PRODUCTION

Constraint: Effect of work on production of cattle and buffalo still unknown.

A serious constraint related to farm mechanization policy in the country has been the lack of good data on the effects of different levels of work on native cattle versus crossbred cattle versus high grade Friesian cattle. It is unfortunate that draft work has not been incorporated into the excellent experimentation that has gone on relative to milk and reproductive characteristics of different grades of crossbred cattle and native cattle. It appears that the optimistic economic appraisal of removing livestock from work

as presented in the ERA 2000 report is unrealistic. The more conservative estimates given in Section I of this paper seem much more applicable. However, in neither case are sufficient research results available to help in making this important economic decision.

Recommendation:

- Information could easily be analyzed in Egypt rapidly if well designed experiments under the competent researchers available could be immediately initiated. This should be included using the cattle genotypes employed in Mostageer experiments.

ISSUE: INCREASED BEEF SUPPLY

Constraint: Slaughtering policies

Slaughtering calves for veal greatly reduces the supply of beef available. So long as the importation of feed grains at low cost to farmers is continued, there will be incentives to feed cattle to heavier slaughter weights than the veal stage as has been commonly practiced. The importation of Irish calves, of breeds not well adapted to Egypt and heavy associated losses are further constraints.

Recommendation:

- Research is badly needed on the development of good local milk replacements for raising early weaned calves from cattle and buffalo. This can greatly increase the number of stocker cattle which would be available for feeding to heavy weights and thus greatly increase the domestic beef supply. If foreign cattle are to be imported live from Ireland, it appears that importation of heavy cattle for direct slaughter at Alexandria seems preferable to the importation of feeder cattle for fattening in Egypt. An expansion of importation of livestock from Sudan for finishing in Egypt also is a possibility.

ISSUE: FRAGMENTATION OF FARM

Constraint: Fragmentation of farms and reduced efficiency in livestock production

As has been indicated in other parts of this report, land in Egypt has been fragmented to the point that most holdings are less than five feddans. This is a very real constraint in the cost of livestock production in almost all aspects. A good example is that given by Squires (1982) of the almost 70 percent greater cost for ammoniation of straw in small quantities versus that in larger quantities. Other examples were given in poultry where costs of feed per kilo of poultry produced in village flocks were pratically double that found on larger commercial farms, as well as a loss of the 25 percent of weight in by-products from slaughter. In many aspects, fragmentation of land holdings leads to greater infrastructure cost per unit of output whether it be vaccination, insemination, feed distribution, banking, etc. Since this is a major policy issue, it can only be treated briefly as a livestock constraint.

ISSUE: LOW INCOME FOR FARM FAMILIES

Constraint: Fragmentation of farms and low estimated labor income for the farm family

Little has been stated policy-wise relative to minimum amounts of labor income per farm family which will induce their full employment in agirculture. A livestock farm, to be efficient, requires the constant concern and care of the farmer and his family. This obviously is not possible if the farmer must be working away from his farm for a considerable amount of time to earn a satisfactory income. We assume that a farmer should be able to earn as a laborer somewhere between LE 600 and LE 1000 per year. It seems reasonable that as a risk-taker and entrepreneur, a farmer should earn something more than a laborer. The Winrock and other data indicate that

this is probably not the case. Obviously it is a matter of great concern to those involved in attempting to improve the quality of life in Egypt that the government concern itself with policies that will lead to placing more of its land and agricultural resources into the hands of fewer but better managers who rise to the top through skill and achievement.

Recommendation:

A revision of land tenure policy along with policies for the gradual consolidation of fragmented lands to economically sized family units would alleviate income problems of small farmers and would lower costs to consumers. No suggestion is made as to what average size farm is required for this, as it would obviously be different in different areas, nor as to how it should take place. Relative to many countries, Egypt has a great advantage in that much of its land already is privately managed; hopefully, the necessary consolidation would not be made at the expense of the private sector. Public sector farms are generally considered to be inefficient.

Because of fragmented land holdings farmers look for outside employment. In the Hopkins (1980) survey 49 percent listed farming as their sole occupation; the figure was 66 percent in the Damanshour survey. The general opinion of these farmers was that five feddans was a minimum sized farm for making a living; they themselves had average holdings of only about two feddans. The inefficiencies resulting from the rigid land policies permeate the entire agricultural system of the country.

POULTRY CONTRAINTS

ISSUE: PROBLEMS IN COMMERCIALIZED POULTRY PRODUCTION

Constraint: Within the poultry industry constraints are somewhat different in the commercial sector than in the village. A number of these are considered together.

The Ministry of Supply which periodically imports large numbers of frozen birds at subsidized prices presents competition to local industries. The Government Poultry Company also sells birds to cooperative outlets at government established prices which ordinarily are lower than those on the open market. One is led to believe that the importation of poultry meat is sporadic and presents a difficult adjustment challenge to the private sector to adjust to. There is also importation of fresh eggs, most of which come from Israel.

A comprehensive report on the current state of the poultry industry in Egypt was prepared by MATH TECH (1980). Constraints to the commercial poultry sector are indicated to relate to the import policy of the Ministry of Supply.

Limitation of consumer income affects the purchasing of whole birds rather than chicken parts (which are not available). Immediate consumption is necessary because of lack of home refrigeration, but this does not appear to be a major impediment to poultry consumption.

Equipment problems persist since the industry largely depends on imported equipment. There are problems relative to the importing of fish meal; improving supplementary soybean oil meal would minimize the need for fish meal. There is no market reporting system.

Recommendation:

- No simple procedure will solve the array of problems confronting the commercial poultry producer. These producers have demonstrated knowledge to solve their problems and to meet with the officials in the proper agencies for maintaining a strong and efficient industry.

ISSUE: IMPROVEMENT OF POULTRY PRODUCTION IN VILLAGES AND ON FARMS

Constraint: Village poultry production as compared to commercial

Village poultry production produces 50 percent of the poultry meat in 5000 villages and about 90 percent of the table eggs (MATH TECH, 1980). Is is indicated that village production does not depend much on the scavenging of food waste. Limited availability of commercial concentrates is considered to be one of the greater deterrents to the village production system. In some circumstances the village poultry producer has become a commercial-type producer, especially in the adoption of commercial broiler raising. There is obviously a considerable spinoff from the commercial sector to the village sector. However, the village system is still pictured as one depending largely upon native hatcheries and upon the native breeds.

The constraints are different for village systems than for commercial systems. Feed analysis if more difficult; it is more difficult to get disease problems diagnosed, candling systems are not available; finally, there appears to be a shortfall in vaccine production

Village egg production per hen is said to average about 75 eggs; in commercial flocks it may be as high as 225.

Village flocks are reported to use more than two times the amount of feed per pound of edible meat produced as do the commerical producers

(MATH TECH, 1980). Also under the village system 25 percent of the recoverable protein is said to be wasted at slaughter. Not all producers are thriving. Of approximately 2500 private units licensed by the government to produce broiler meat in late 1979, 50 percent were no longer in production less than one year later.

Recommendation:

- The MOA should be encouraged to continue its excellent work on the genetic improvement of laying hens for the village poultry producer. Indications are that present improved poultry strains for villagers may produce twice the eggs of native hens. Other constraints are not so easily managed. This is largely because of a lack of a technological delivery system to the farmwife, on whom the poultry industry primarily depends. It is strongly urged that young village women be given special training in all aspects of poultry production and health so that they can help introduce the technological improvements feasible under primitive village conditions.

GRAZING ANIMALS CONSTRAINTS

While Egyptian livestock generally appear to be maintained in good condition, an important observation relative to their expected reproduction and production of milk and work is that there is generally a surplus of energy and particularly protein during the berseem period of January to April.

ISSUE: LOW QUALITY INADEQUATE SUMMER FEED FOR RUMINANTS

Constraint: Lack of summer forage

The long non-berseem period from May to December has been pointed out by many observers as the difficult time for livestock. Even then, the Winrock Report (1980) indicates that the animals are provided with their minimal nutritional requirements and supplementation is commonly done by grazing along ditch banks, stripping of maize leaves, and some feeding of straw. This is the period when most government concentrates and straws are fed. The methodology of the Egyptian farmer in providing for his livestock during the non-berseem period falls somewhere between that of the Western farmer in temprate zones where abundant stored feed supplies are used to fatten or maintain animals in winter and the contrasting period of starvation and often death loss incurred in the dry seasons in the tropical savannas of Africa, Australia and Latin America.

Recommendation:

- Winrock suggests that this lack of grazing be modified in two ways: first, by using non-protein nitrogen in the government concentrates and thus extending those concentrates as supplements to maize; second, by devoting a small area to a high-producing forage such as Napier grass to help sustain the livestock during the non-berseem period. Perhaps more important, and applicable to many small farm systems in Egypt, would be the use of the new forage sorghums which have yields

of up to 30 tons per feddan in four months. Being a temporary crop, they would fit into crop rotation programs more easily than Napier grass, which is a perennial. Recapping the opportunities for providing more and better feed during the non-berseem period, we see (1) an important opportunity in the ammoniation of straw, a process which, because of current economic conditions, is not likely to be presently adopted on a wide scale, (2) extending use of concentrates through the incorporation of more molasses and some urea as the non-protein nitrogen, and (3) the prospect of planting high-yielding sorghum grasses or Napier grass for providing supplementary summer forage for the non-berseem period.

From a food security standpoint, the government ration of imported low cost grain is the most vulnerable of the constituents of summer feeding. However, it appears that there are ample opportunities, particularly through the ammoniation of straws and improved summer forages, to become independent of these imported grain concentrates for ruminants.

IV. STRATEGY IN ANIMAL PRODUCTION

Egypt, a country that has accomplished the impossible repeatedly in recent decades, has tremendous potentials. This undoubtedly will apply in its search for a humane and acceptable equilibrium between food supply and population. It it succeeds, it will be a model for all.

Some personal thoughts relative to strategy transcend straight technology, as all aspects of the social and work pattern are interwoven. A note of concern regards international funding, which may be jeopardized as a consequence of evidence that its distribution may not be directed toward those intended or that disproportionate amounts may have been channeled to "pet" projects or disciplines. Both situations are to be deplored, even in isolated instances.

SHORT-RANGE STRATEGY WITH BUDGET SAVINGS:

1. Phase government out of the farming business and out of the livestock business. Offer these facilities to the private sector in an acceptable financial, social and political manner.

2. Drop artificial insemination as a standard part of village veterinary services. Offer to sell crossbred Friesian bulls from government farms at market prices or at auction. A cost benefit analysis may be required before this action is taken. Artificial insemination appears to have failed at the small farmer level.

3. Program argicultural systems analyses for new projects or governmental regulations before they are initiated. This should permit better insight regarding overall economic considerations of proposals.

4. As soon as subsidized feed grain purchases diminish, cease importation of Irish or other European stocker cattle for fattening in Egypt.

5. Cease subsidizing importation of unadapted European milk cows.

6. Encourage through profit motivations increased sales of high quality animal health supplies by village pharmacies or suitable private merchants. (See problems listed in animal health section.)

7. Charge farmers for animal health drugs and vaccines; they should be paid for like seeds and fertilizers. Only for government-mandated vaccination programs should there be no charge.

8. Offer "elite" international assistance with emphasis on the Middle East. Dispatch a small international team that is Egypt-oriented to the Pan American Agricultural School, Zamorana, Honduras, Central America, to study the feasibility of establishing a similar small elite facility for imporving the "hands-on" approach in agricultural higher education in the Middle East. Such a school would serve a small international student body with a small international faculty funded on an international pay scale. This should be attractive to a wide range of donors.

9. Other U.S. programs through which scientists of Egyptian selection may be brought to Egypt apparently are not being utilized in agriculture. These include the Fulbright program and the International Executive Service Corps.

LONG-TERM STRATEGIES WITH LOW BUDGET REQUIREMENTS

1. Develop a small international team of recognized experts to put together a proposal for establishing an international center for buffalo improvement in Egypt. The team should have good contacts with the Consultative Group, UNDP, OPEC, Canadian, German, Japanese, and U.S. donor government groups.

The appeal to Egypt should be to host an elite international research project in agriculture with direct application to the rapid improvement of its most important economic animal--the buffalo. Since buffalo is so important to the Middle East, Far East, Africa, and Asia, the project should have great appeal. Several aspects of buffalo improvement should be incorporated, including breeding, feeding, health, and management.

2. Invite Dr. David Robinson, Project Manager, Small Ruminant Project, University of California, Davis, to meet with a distinguished group of Egyptian experts in animal breeding, animal nutrition, animal health, and range management so that this group could discuss a joint Egyptian-USA effort in small ruminants--sheep and goats. The Desert Research Institute should also be represented. The purpose would be to establish an international long-term set of relationships by professionals of exceptional scientific quality to focus on this important and neglected aspect of animal production; U.S. universities of high capability in this area should definitely be involved.

3. Encourage the immediate development of Egyptian scholarships in U.S. for key areas of importance such as: hydrolyzation of straws at University of Nebraska; ova transplantation from buffalo into cattle at Florida; Ag-Net procedures as at Nebraska; training of women in para veterinary-animal production for village work (perhaps at Ohio State) with special assistance from Dr. Francille Firebaugh.

LONG-TERM STRATEGIES REQUIRING BUDGETARY INCREASES

Egyptians have been accustom[illegible] to allocating less than one percent of their governmental budget to [illegible]tural research and extension. Present input through donor funds [illegible] be much larger. There is concern as to what will happen to the MOA and universities' agricultural development

when donor funds are decreased. In some countries, such as Colombia, this withdrawal of donors has been disastrous. In other cases, such as India, the research organization has apparently remained effective with the help of international centers. Despite these hazards there are opportunities which call for additional funding and personnel over an extended period.

1. Quality of research: A major porblem exists regarding the basic ingredients required for quality research. Namely, international-level salaries must be offered to the best scientists so that they may devote all of their energies to research. Modern equipment and good operating budgets are essential. Perhaps methods presently exist whereby a few scientist and their projects could be protected at international salaries even if this were to happen at the expense of a portion of the multitude of under-supported and underpaid MOA and university employees.

The present use of international funding to highlight critical high-priority research seems to be the best temporary solution in key research areas as it provides funding for the essential equipment and expertise.

2. Quality of education: An enlarged television delivery system should be developed for dealing with the massive number of university students in general agricultural studies. This would require very little hands-on experience on the part of these students. A library-TV-examination degree much like correspondence courses should maintain the low-cost open-door policy of universities.

3. Availability at one site in Egypt to small numbers of highly selected students in essential specializations: These major study groups should be limited to not more than 30 students or a student body no larger than 300-500, naturally. Examples of essential fields of study: Agricultural Computer Science, Animal Science, Crop Science, Farm Mechanics, Horticulture and Veterinary Science.

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APPOINTMENTS IN EGYPT

March 1 - April 15, 1982

Dr. M. el Shafie, Animal Physiology, University of Cairo

Dr. A. Mostageer, Animal Breeding, University of Cairo

Dr. Arif Abd Salem, Director, Desert Research Institute

Dr. Hassan Rafael, Extension

Dr. Elwy Atalla, Director, Plant Protection Institute

Dr. Saad Abdel Ghaffar, Director, Animal Health Institute

Mr. Ali Ezzat, Milk and Egg Producer

Mr. Gamal Khaled, El Shabat Project

Dr. Gamal Kamar, Head, Animal Production, Cairo University

Dr. T. M. Ragab, Emeritus Head, Animal Production, Cairo University

Mr. ReKaby Agrahim Hassnen, Director, Agriculture Dept., Aswan

Mr. Aly Mohamed Abu el Kasim, Chairman, Public Relations, Aswan

Dr. M. A. El Maghraby, Dean, Faculty of Education, Aswan

Mr. Nagab el Ohagali, Engineer of Animal Production, Aswan

Mr. Ahmed Abou Doah, Director of Kom Omba Agricultural Station

Dr. Saad Labib, Pyramid Research Animal Reproduction Laboratory

Dr. Ahmed Rakha, Director, Pyramid Research Animal Reproduction Laboratory

Dr. Fikry El Qerabi, Animal Physiologist, Sakkha

Dr. Yousry Safwat, Nubaria Beef Project

Dr. Richard Tinsley, Water Project

Dr. William Hargus, Nubaria Beef Project

Dr. M. Kheir el Din, Undersecretary, Animal Production

Mr. Ibrahim Fuad Sayed, Director, Animal Production Research Institute

Dr. Saad Abdel Khaffar, Director, Animal Health Institute

Dr. Youssef Wally, Mininster of Agriculture

Dr. Mounir Naghmoush, Department of Foods, Dairy Science and Technology, Cairo University

Dr. Ahmed El Sahriji, Director, Farm Machinery Project

Peter Reese, Effects of Mechanization, Training Center

David Gaisir, Chief of Party, Mech. Training Center

Dr. Y.L. Awad, Biochemical Department and Animal Health Research Unit

Dr. H. M. El Sawah, Food Hygiene, University of Cairo

Dr. Abdel Afar, USAID Projects on Bacteriological viral disease

Dr. Yehia M. Hassan, Fisheries, Professor at Ain Shams

EGYPT: STRATEGIES FOR ACCELERATING
ARGICULTURAL DEVELOPMENT

ANNEX H

AN OVERVIEW OF THE HEALTH OF LIVESTOCK IN EGYPT

By

William R. Prtichard, Dean, College of Veterinary
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ANNEX H: AN OVERVIEW OF THE HEALTH OF LIVESTOCK IN EGYPT

I. INTRODUCTION

Diseases and parasites cause heavy losses to the livestock and poultry industries and the wastage of hundreds of thousands of tons each year of high-quality human food through death of animals and reduction in productivity. Although data upon which losses might be quantitated are not available, it is estimated that losses of meat exceed 100,000 tons per year and milk over 500,000 tons per year. Neonatal disease losses among cattle buffalo during the first 2 months of life commonly reach 40 to 50 percent in larger herds and exceeds 25 percent for the country as a whole. Most of these losses are from enterides, septicemias and pneumonias complicated by parasite infections, poor nutrition and inadequate sanitary procedures. Diseases of reproduction and low reproductive performance cause severe losses in the productivity of cattle and buffaloes. Thirty to forty percent of the adult female population of these species are estimated to be afflicted with reproductive problems at any one time. Parasitic infections particularly gastrointestinal nematodes in young cattle, buffalo and sheep, & liver flukes in cattle and buffalo cause excessively heavy losses. Nutritional and metabolic disease problems associated with high-nutrient intake during the berseem season and inadequate nutrition during the rest of the year significantly reduces the productivity of livestock. White muscle disease of young cattle buffalo and stiff lamb disease of sheep, post- and pre-parturient paresis in milking buffaloes and cattle, and ketoses in buffalo, sheep and cattle are a few examples. Several nutritional deficiencies cause specific clinical disease, but more importantly predispose animals to infectious agents and parasites. Losses from disease of all kinds is greatly exacerbated by the nutritional state of herds and flocks. Poultry are afflicted with parasites and numerous serious infectious diseases unless vaccinated, whether kept in village flocks or in modern confinement systems.

It is important to note that the major epidemic diseases such as rinderpest, contagious bovine pleuropneumonia, food-and-mouth disease, Rift Valley fever, African horse sickness, Newcastle disease and blue tongue--all of which are capable of disrupting livestock production and killing or debilitating large numbers of animals during a single outbreak--have been brought under control by the veterinary services of the Egyptian government. Ongoing vaccination and preventive programs combined with close control of importation can be expected to effectively prevent the occurrence of devastating outbreaks of these diseases.

Because the major epidemic diseases are being controlled, it is often erroneously supposed that disease is not an important factor in constraining livestock productivity in Egypt. Nothing could be further from the truth. Often inadequate nutrition is intimately related to nutritional problems, while diseases and parasites constitute the next most important factor reducing productivity in the livestock industries of Egypt. There can be no significant improvement in the overall productivity of the livestock sector until decisive steps are taken to control the many disease problems afflicting the livestock industries in Egypt.

II. THE ANIMAL HEALTH DELIVERY SYSTEM IN EGYPT

A. CURRENT STATUS:

The health delivery sustem consists of the following components:

1. Veterinary clinics located throughout the country which provide animal and poultry health services to animals brought to them, as well as sexual health services including artificial insemination,

2. Veterinary vaccination and preventive medical clinics which manage the extensive vaccination, testing and disease control programs of the Ministry, designed to control epidemic infectious livestock diseases, and

3. A well-developed system of veterinary inspection and quarantine devised to protect the Egyptian livestock industry from animal diseases that might be imported with the large numbers of live animals and poultry products coming from throughout the world. Laboratory diagnostic, investigational and research support is provided through an extensive system of laboratories and institutions maintained by the Veterinary Division of the Ministry of Agriculture. Vaccines and biologicals are produced in laboratories maintained by the Ministry in Abbasiya. Three Faculties of Veterinary Medicine provide the trained personnel for the system.

The veterinary services units must be commended for the quality and success of their efforts to control epidemic infectious diseases. The extensive vaccination and control programs have largely eliminated the threat of these diseases. The quarantine services are effectively controlling the introduction of new and old infectious diseases. However, the present animal health delivery system is not coping successfully with the multitude of endemic infections and the production diseases such as diseases of the newborn, reproductive diseases, metabolic and deficiency diseases, mastitis and parasite infections. Major changes must be instituted to deal with these diseases which are so different epidemiologically

from the epidemic diseases with which the system has had so much success.

B. CHANGES NEEDED IN THE ANIMAL-HEALTH DELIVERY SYSTEM

To cope successfully with the animal health problems currently confronting Egyptian livestock will require changes in the animal health delivery system. Access to veterinary clinics by village animal-owners must be improved. At present clinics serve up to ten villages each. Additional clinics need to be established. The Ministry of Agriculture's goal of establishing a clinic in every one or two villages is realistic. At the present time the veterinary clinics are staffed by veterinarians specializing in reproductive diseases and artificial insemination, poultry diseases or other diseases. Specialty sections dealing with diseases of the newborn, parasite infections, and metabolic and deficiency diseases should be established. These specialists must orient their efforts to on-the-farm prevention programs rather than treatment of infected or sick animals brought to the clinics. All of these disease problems result from the interaction between disease and husbandry practices. Both the problems and the solutions are related to on-the-farm practices. All of these diseases can be controlled with the institution of preventive measures supplemented by drug treatment. Successful control will require on-the-farm advice on such matters as sanitation procedures, provision of colostrum to the newborn at birth, hand-feeding for parasite control, proper supplementation of diets to prevent metabolic diseases, etc. The veterinary diagnostic support services should be strengthened to provide back-up support for these expanded clinical programs. The research programs of the Animal Health Institute should provide research support for these newly expanded initiatives. It is especially important to greater competency in epidemiology and systems analysis to support research on improved strategies for the control of endemic diseases.

III. DIAGNOSTIC SUPPORT SERVICES

The effectiveness of animal-health delivery systems, whether or not they deal with epidemic infectious diseases, sporadic infections, endemic disease or preventing the importation of exotic livestock infections, depends to a very large extent upon the quality of the diagnostic services available to support these activities. Spectacular progress has been made in recent years in veterinary diagnostic techniques. Many new, extremely accurate procedures have become available for general use within the last five years. The veterinary diagnostic laboratory system should be provided with skilled specialists, instrumentation and other resources to provide vitally needed diagnostic services to the entire animal-health delivery system. A highly sophisticated National Animal Disease Diagnostic Laboratory staffed by skilled specialists in pathology, immunology, virology, bacteriology, parasitology, computer scineces, chemistry, toxicology and other diagnostic laboratory sciences is very much needed. Branch diagnostic laboratories which could conduct simple tests and examinations would collect and refer proper specimens to the central laboratory for examination.

A. VACCINE PRODUCTION

The Ministry laboratories for vaccine production at Abbasseya have served the country well and have provided effective vaccines for many important diseases. They are, however, in need of new facilities, equipment and resources. Vaccine production science is changing rapidly. For example, through recombinant DNA technology foot-and-mouth disease vaccine production techniques have been revolutionized. Similar advances are in progress with other vaccines. The new technology will require new equipment, new personnel and new facilities. Many new animal pathogens are constantly being discovered for which vaccines are needed. In view of the growing complexity of the vaccine situation the Ministry should give serious thought to the purchase of its major vaccines from the world's most reliable sources. The laboratories at Abbasseya should be devoted to the production of the special vaccines, biologicals and diagnostic reagents

and serums that are needed for Egyptian strains of micro-organisms and for any special Egyptian needs of which we know there are many.

B. DISEASES OF WATER BUFFALO

The water buffalo, one of the world's most important ruminants, has particular value in underdeveloped tropical countries of the world. It is known to be susceptible to many diseases and parasites which also affect cattle, but in many instances it is less susceptible than cattle to these diseases. It is more susceptible to a few. There is an urgent worldwide need for more information of diseases of water buffalo, their prevention and control. Because the water buffalo is so important in Egypt, perhaps the most important animal, the Ministry should consider participating with relevant international agencies (Food and Agriculture Organization of the U.N. the Consultative Group on International Agricultural Research) on international projects on the biology and diseases of water buffalo.

The U.S. Agency for International Development should be made aware of the fact that there are many highly competent veterinary investigators in Egypt with experience doing research on the diseases of water buffalo who can contribute in very important ways to AID initiatives on water-buffalo disease research.

C. SMALL RUMINANT DISEASE RESEARCH

Small ruminants play an important role in food production in Egypt. The native breeds of fat-tailed sheep are highly prized as food animals while the goat contributes significantly to both red meat and milk production. The small ruminants in Egypt are subjected to numerous infections, such as blue tongue Rift Valley fever, brucellosis and parasites. There is, however, great potential for expanding the usefulness of these species, expecially the goat for milk production.

In view of the importance of the small ruminant in Egypt and the relative sophistication of research on infectious diseases, it is strongly

recommended that a small ruminant project supported by AID, be developed as part of the Small Ruminant Collaborative Research Support Program of the AID. This project should have an important health component.

IV. ZOONOSES

At the village level people and animals live in close proximity with a great deal of contact occurring between them. Many infectious agents are capable of causing disease in both animals and people. These diseases are called the zoonoses. Zoonoses are an important source of human disease in Egypt. Such diseases as brucellosis, Rift Valley fever, Leptospirosis fascioliasis, hydatid disease, and many many others contribute significantly to morbidity and mortality among rural people in Egypt. Because many zoonoses induce chronic and debilitating diseases in people, they limit the ability of rural people to work.

It is important to the quality of life in rural Egypt and indirectly to food production to develop cooperative programs between the Ministry of Agriculture and the Ministry of Health for the control of the Zoonoses.

V. SUMMARY

Diseases and parasites cause heavy losses to the livestock industries of Egypt through death of animals and reduced productivity. The many epidemic infectious diseases such as rinderpest, Rift Valley fever, foot-and-mouth disease, Newcastle disease and many more are being effectively controlled by vaccination and prevention programs. The endemic infectious diseases, parasitic infections and metabolic and deficiency diseases, on the other hand, are not well-controlled and result in serious reductions in the productivity of livestock production in Egypt. In order to reduce these losses, a series of changes in the animal health delivery system will be required:

--Access to veterinary clinics must be improved to provide expanded services to livestock. Additional clinics probably are needed.

--Programs with qualified specialists must be developed to provide on-the-farm preventive services to control losses due to diseases of new born, parasitic diseases and metabolic and deficiency diseases.

--The veterinary-diagnostic-laboratory capability of the country must be improved to provide needed back-up support for the broadened clinical program.

--the national veterinary research program must provide research support for the broadened clinical program.

--The Ministry should give serious consideration to the importation of many of its vaccines reserving the laboratories at Abbaseya for the production of vaccines, biologicals and diagnostic reagents unique to the needs of Egypt.

--Joint programs between the Ministries of Agriculture and Health should be developed to deal with zoonoses at the farm level.

--The curriculum at the Faculties of Veterinary Medicine should take into account the broadened role of the veterinary clinics and adjust their education program to better meet these needs. More emphasis

is particularly required in epidemiology.

--It would be beneficial to Egypt and the world to articulate its water buffalo biology and disease research program to align it closely with the growing worldwide effort in this area.

--A favorable response should be given by the Ministry and USAID to the development of a small-ruminants project as part of USAID's collaborative Research Support Program.