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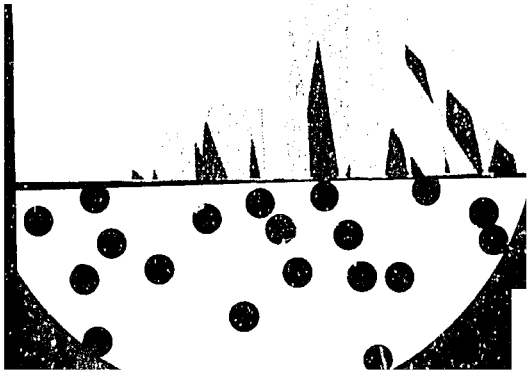
Seminar on Key Management Problems In The Marketing, Distribution & Use Of Fertilizers



CENTO seminar on

Key Management Problems in the Marketing, Distribution & Use of Fertilizers

held in Islamabad
January 7-10, 1974

A.I.D.
Reference Center
Room 1656 NS

FOREWORD

The threat of a world-wide shortage of food is very real. Present rates of food production will not be able to keep up with the rate of population growth. This problem is especially ominous in the CENTO Region, where birth control and adequate agricultural production remain inadequate even at present. At this Seminar on Key Management Problems in the Marketing, Distribution and Use of Fertilizers, it was agreed that more efficient use of fertilizers could increase crop production in the three Regional Countries and thereby, hopefully, waylay the possibility if famine in this part of the world.

The fact that fertilizer is needed and has proven to be greatly beneficial is a simple fact. Behind this lies the problems of adequate raw materials, the introduction of irrigation systems, efficient fertilizer plant production, and effective and timely distribution of fertilizer to the farmers. In the following pages, the delegates from the Regional Countries and the United Kingdom and the United States compared experiences with these problems and moved toward a more unified effort in solving them.

Because the crop production and fertilizer needs are quite similar in the three countries, a common evaluation and approach is appropriate and perhaps necessary. As a result of this Seminar it was agreed that inter-regional trade of fertilizers, experts, and information should be expanded. At the conclusion of this Seminar twelve points of recommendation were decided upon - points which, if effectively considered and put to use, could greatly benefit the agricultural and economic situations of the CENTO Countries far into the future.

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the CENTO Report

The Seminar on Key Management Problems in the Marketing, Distribution and Use of Fertilizers was held at the Auditorium Room, Planning Commission, Secretariat Complex in Islamabad, January 7-10, 1974. All member governments were represented at the meeting.

The Seminar was called to order by Mrs. Fugen Ok, the representative of the CENTO Secretariat.

The Address of Welcome was given by Mr. M. Yakub, Secretary of the Ministry of Food, Agriculture and Rural Development in Pakistan.

As it is traditional in CENTO meetings for the leader of the host country's delegation to act as Chairman, the leader of the Pakistan Delegation, Mr. Jehangir Shah Jogazai, was invited to take the chair. Dr. Darrell A. Russel was elected as Co-chairman.

The leaders of the Delegations of Iran, Pakistan, Turkey, the United Kingdom and the United States then made opening remarks.

The agenda was adopted during the meeting with the suggested amendments.

The Keynote Address, "The World Fertilizer Market and Its Impact on the CENTO Region", was delivered by Dr. Victor L. Sheldon, of the United States.

In the discussion following the keynote address it was generally agreed that there was considerable potential for greater economic use of fertilizers throughout the CENTO Region. Referring to the keynote address, Pakistan considered that the forecast of a growth rate for the region culminating in a 40% to 50% increase in consumption by 1980 was an underestimate. Whilst it was felt that these objectives could be regarded as the minimum to aim for, it was recognized that their fulfil-

ment was dependent upon the availability of raw material and increased output within the time scale.

The rapid increase in fertilizer prices was of particular concern to developing countries and would have to be offset by equivalent increases in the price of farm products. It was considered unlikely that input prices would fall because they are derived from the complex elements of world inflation and not solely as a result of increases in the price of raw materials.

The possible use of anhydrous and aqueous ammonias in the region, particularly the introduction of ammonia into irrigation systems, was debated. The conclusion was that the introduction of N into irrigation systems produced unreliable and quite variable results due to uneven distribution. So far as aqueous ammonia is concerned, the low concentration of N in a high volume of water aggravated the distribution problems.

The present and forecast world shortage in fertilizer output demands the maximum efficiency in plant utilization and distribution. It was thought that there was a need for both national and international planning to minimize waste. In particular, the developing countries should aim to improve their transport and storage facilities to keep up with their increasing production of fertilizer and agricultural products.

PRESENTATION AND DISCUSSION OF PAPERS

Theme I *Fertilizer Marketing Systems in the CENTO Region*

The Delegate of Turkey, Mr. Sezai Bayraktar, presented a paper on, "Fertilizer Marketing Distribution and Use in Turkey". (page)

The Delegate from Pakistan, Dr. Mohammad Aslam Chaudhry, presented a paper on, "Some Economic and Institutional Aspects of Fertilizer Marketing in Pakistan". (page)

Theme II *Factors Limiting Fertilizer Use in the CENTO Region*

The Delegate from Iran, Mr. Ali Seyed Ahmedian, presented a paper on, "Marketing Distribution of Chemical Fertilizers: Factors Restricting Consumption of Chemical Fertilizers in Iran". (page)

The Delegate from Turkey, Mr. Sezai Bayraktar, presented a paper on, "Limitations of Fertilizer Use in Turkey". (page)

The Delegate from Pakistan, Mr. Musahib-ud-din Khan, presented a paper on, "Limitations of Fertilizer Use in Pakistan". (page)

Theme III *The Establishment and Operation of an Effective and Efficient Marketing Organization*

The Delegate from Iran, Mr. Ghulam Hussain Ghandehari, presented a paper on, "The Role of the Private Sector in Fertilizer Distribution in Iran". (page)

The Delegate from Pakistan, Mr. Khawaja Amanullah, presented a paper on, "The Role of Private Sector in Marketing Fertilizers in Pakistan". (page)

The Delegate of the United States, Dr. Victor L. Sheldon, presented a paper on, "Building an Effective Marketing Organization". (page)

In the discussion following these presentations, it was recommended that the utilization of human resources should be re-emphasized as an integral part of an effective marketing organization. The key to utilization is the training programme - conducted at all levels and for virtually every employee in the company. It matters little whether the company is in the private or the public sector, marketing objectives will be identical and organization nearly the same. In either sector, the company must have adequate flexibility to respond to changes in the market and in marketing objectives. If the company is in the public sector, great care must be exercised that the company does not revert to bureau status and that it does not hide inadequacies behind a government facade.

Theme IV *Developing the Market for Fertilizers*

The U.S. Delegate, Dr. Darrell A. Russel, presented a paper on, "The Role of Fertilizer in Agricultural Development in CENTO Countries". (page)

The Delegate from the United Kingdom, Mr. K.E. Smallpage, presented a paper on, "Philosophy of Fertilizer Distribution and Storage Schemes". (page)

The Delegate from the United Kingdom, Mr. K.F. Isherwood, presented a paper on, "General Trends in Fertilizer Marketing". (page)

Mr. Karl Wierer, from the Food & Agriculture Organization of the United Nations, presented a paper on, "A Comparative Analysis of Fertilizer Marketing in Selected Countries". (page)

The Delegate from Pakistan, Mr. Syed Abu Khalid, presented a paper on, "The Philosophy and Role of Market Development in Increasing Fertilizer Use in Pakistan". (page)

In the discussion that followed it was suggested that a low literacy rate can be overcome by communication especially with young people and by means of picture comics, etc. Also, emphasis must be placed on person-to-person contact. It was also decided that the 20 kg/hectare rate of plant nutrient application was a worldwide figure. This level of application has already been surpassed in Pakistan and food sufficiency had not been attained. Credit can be subsidized through credit co-operatives (Production Credit Associations) and should be farmer-oriented and separate from the marketing channel.

It was concluded that concentrated forms of fertilizers should be emphasized as they will become even more important in the future. Phosphate deposits may be processed into elemental phosphorous for transport to consuming areas where it can be made into plant foods. TVA* has developed new products like polyphosphates which will replace current orthophosphates. The research of TVA is being conducted on elemental N-P materials for future use. Now fuel shortages will expedite the introduction of more concentrated products.

Blending fertilizers centrally in the CENTO Countries was not recommended by the U.K. or U.S. delegates because it required a large capital outlay and special skills.

It was also mentioned that bags for use in CENTO manufacturing facilities are now in critically short supply.

Theme V *The Logistics of Fertilizer Use*

The Delegate from Pakistan, Dr.A. Rahim Chaudhry, presented a paper on, "Farmers and Fertilizers (Meeting the Farmers' Needs)". (page)

The Delegate from Turkey, Mr. Mahmut Erdir, presented a paper on, "The Problems of Marketing and Distributing Imported and Domestically Produced Fertilizers - Turkey's Experience". (Page)

The Delegate from the U.S., Dr. D. Robert Schmeltz, presented a paper on, "Fertilizer Distribution and Storage". (page)

* *Tennessee Valley Authority*

The Delegate from Iran, Mr. Iraj Massiri-Toossi, presented a paper on, "Economics of Fertilizer Use on Major Crops in Iran."

The Delegate from Turkey, Mr. A. Kemâl Acarer, presented a paper on "Farmers and Fertilizers (Meeting the Farmers' Needs)". (page)

In the discussion that followed this theme, it was suggested that the CENTO Countries band together to study and procure a supply of phosphatic fertilizers and to share knowledge. It was suggested that they enter into long-term agreements in order to ensure their plant/food needs.

Packaging was discussed so that some solution might be found to the current high costs within Pakistan. Turkish delegates stated that in their experience jute bags were superior to polypropylene, due to handling in the field where humidity is high. Bulk handling is of limited value at present.

Theme VI *Promoting Fertilizer Use*

The Delegate from Pakistan, Mr.K.M. Azam, presented a paper on, "The Economics of Fertilizer Use on Major Crops in Pakistan". (page)

The Delegate from Turkey, Mr. Kemâl Kaptan, presented a paper on, "The Role of Credit in Promoting Fertilizer Use in Turkey". (page)

The Delegate from Iran, Mohammad Taghi Jebraili, presented a paper on, "The Role of Extension and Education in Promoting Fertilizer in Iran". (page)

The Delegate of the United States, Dr. Darrell A. Russel, presented a paper on, "The Role of Communications in Promoting Fertilizer Use", prepared by Mr. Victor L. Sheldon and John E. Culp. (page)

In reply to a question from Mr. Wierer, Mr. Jebraili said that there was no problem in finding suitable employment for people in agriculture. The problem was rather to provide educated personnel for the agricultural sector. The problems of credit repayment and abuses of credit, such as the resale of fertilizers supplied on credit, were discussed. In Pakistan, measures currently being adopted to ensure credit repayment were: the paying of a small commission to collection agencies, and ensuring that the farmers repay promptly on harvesting the crops. Col. Shaukat Ali of Pakistan, said that the abuses, which in fact concern only a small proportion of total credit, should not be allowed to undermine the provision of credit in general. In any case, the abuses disappear when supplies are adequate.

CONCLUSIONS AND RECOMMENDATIONS

In the last five to six years, the awareness of the need for fertilizers has increased in all three CENTO Countries. Use has increased because of the growing knowledge of farmers about fertilizers. Projections of the use of fertilizer have become more and more optimistic. But, the world fertilizer situation demands that the three countries re-evaluate these projections. The many similarities in crop production, fertilizer needs, and other fertilizer problems suggest that a common evaluation may be appropriate. There are still other factors that lead to the suggestion that a multi-nation or regional approach is desirable. It is obvious that each country needs additional quantities of fertilizer - nitrogenous, phosphatic and potassic - and that the internal distribution systems in each country need to be improved. In view of these conditions, as well as those detailed in the preceding abstracts and discussions, the following recommendations are made:

1. There is a substantial opportunity to develop inter-regional fertilizer trade among the three countries when surpluses occur because the peak months of fertilizer consumption occur at different times in each country. Excess production during months of low demand in one country could be marketed in the other countries. Arrangements for such trade should be made now.

2. There is an urgent need to strengthen the network of retail outlets in all countries. These outlets, whether in the private or public sector, should offer a package of all necessary inputs, including all types of fertilizers that are needed by farmers.

3. Concentrated fertilizers provide distinct economic advantages over low analysis fertilizers. Concentrated fertilizers consistent with soil requirements should be introduced and popularized among farmers. Furthermore, high analysis fertilizers should be preferred when considering future production facilities.

4. The capabilities of both the public and private sectors should be fully utilized in developing an effective marketing system. The distribution network should have a strong element of competition in order to improve the quality of service to farmers within the social and political environment of the country.

5. Adequate credit from both public and private sources should be made available to farmers and should be limited to all retail outlets regardless of whether they are in the public or the private sector.

6. The enormous requirement for fertilizer packaging materials in the three countries underlines the need for developing a coordinate investigation of a joint operation of a plant to manufacture such materials.

7. Improvement in infrastructure has been neglected too frequently when a new industry has been formed or an old industry has been extended. Consequently, there now exists an acute deficiency in the infrastructure needed for the fertilizer industry to adequately perform its functions. The three CENTO Countries, individually and collectively, must find some means to impress upon their governments the need to allocate resources in such a way that fertilizers can be transported rapidly and economically to the areas where they must be used.

8. Fertilizer laws should be regulatory in nature, rather than restrictive, and should be uniform for the CENTO Region. Agencies responsible for enforcing fertilizer laws should not function outside the regulatory field.

9. An association of all interests concerned with the manufacture, marketing, and distribution of fertilizers should be formed in each country. Following formation of the country associations, a regional federation should be developed. It would be the function of the federation to exchange views, data, and experience, especially with reference to the utilization of natural resources for fertilizer production; the dissemination of experimental data related to the use of fertilizers; educational programmes and techniques for farmers and distribution; packaging, transportation, and distribution facilities; and sources and uses for farmer credit. The objective of this association is the development of a common marketing strategy and the best use of the available skill, knowledge and material resources and manufacturing capabilities in all the countries.

10. It is recommended that a vocational school be established cooperatively by the three CENTO Countries for the express purpose of training individuals to function efficiently in the various segments of the fertilizer distribution and marketing industry. Training would be provided in such areas as the logistics of fertilizer movement; management and care of transportation equipment; warehouse and storage depot management; personnel supervision; sales techniques; operating retail establishments; conducting training courses for farmers; trends in fertilizer production and use; and such other topics that appear necessary to ensure a knowledgeable and capable graduate. Students would be required to have completed training in

agriculture. The school also would provide short courses for the purpose of maintaining the competency of its graduates. Special courses also would be designed for extension agents. To attain this objective, it was recommended that training in the specific areas mentioned above should be sponsored from MTCF resources of CENTO.

11. At the time when new fertilizer capacity is being established in any of the three countries, the prospective investors should allocate an adequate proportion of the financial outlay to the provision of appropriate transport facilities. Complete reliance on the Government for development and expansion of the existing transport facilities may not be a realistic approach.

12. The Seminar recommended that seminars on the impact of modern technology on fertilizer production, marketing, and use in the CENTO Countries be conducted within the next six months. These topics originated from the great interest developed when topics relating to this subject were briefly mentioned in this Seminar.

ACKNOWLEDGEMENTS

The Delegates expressed their thanks to the Government of Pakistan for their extreme hospitality and the excellent arrangements for the meeting. They also thanked the Chairman for the able way in which he conducted the meeting and the Secretariat for the efficient way they served the meeting.

the Welcome Address

Mr. M. Yakub

It gives me great pleasure to welcome the delegates from the friendly CENTO countries participating in this Seminar on Key Management Problems in the Marketing, Distribution and Use of Fertilizers.

Agriculture constitutes the base of Pakistan's economy; it contributes 35% of the Gross National Product, and provides employment to over three-fourths of the population. Agricultural products, particularly rice and cotton, are main sources of foreign exchange earnings and cotton processing is the major industry of the country. However, the country is not self-sufficient in food.

To meet the requirements of the rapidly increasing population and to raise its current low standard of living, it is necessary that agricultural production should not only keep pace with but quickly outstrip the increase in population. With limited availability of land and water resources, the bulk of this additional production will have, of necessity, to come from intensive farming and increase in the yields per acre.

Such increased yields are now possible through the development of high yielding varieties of plants, adoption of improved agronomic practices and the application of adequate plant nutrients. The last one is of immediate significance to the farmers. Through subsidized sale of fertilizers, the farmer in Pakistan has since grown accustomed to its use and he is now more demanding. He has to be provided with adequate quantities of the right type of fertilizers at the right time. This involves development of new techniques for marketing, distribution and use of fertilizers which is the subject of this Seminar.

Though the pressure on land in the neighbouring countries of Iran and Turkey is not so great as in Pakistan, the problems confronting agricultural production are more or less similar. I am certain that your discussions on these problems will be very fruitful. The presence of representatives from the United Kindgom and the United States of America, where the agricultural sector has made spectacular advances and the farmers are well versed with mechanized farming and the application of agricultural inputs to enhance production, will provide useful guidance to the countries of the Region.

The Seminar will be of particular relevance to Pakistan at this time when the marketing and distribution of fertilizers has been decentralized to the Provinces and the public sector has also been inducted. A reconnaisance Soil Survey of the country has been undertaken and detailed soil surveys are now in progress. The deliberations of this Seminar will provide useful guidelines in the development of the new infrastructure for the distribution and use of fertilizers.

The agenda of the Seminar is fairly exhaustive but I would venture to suggest that the Seminar could give consideration not only to the marketing, distribution and use of fertilizers in individual countries of the Region, but also to the feasibility of Inter-Regional trade in fertilizers.

I wish your Seminar success. I would also like to congratulate the CENTO Secretariat and the Country Co-ordinators for their efforts in organizing this Seminar.

MR. M. YAKUB, SECRETARY OF MINISTRY
OF FOOD & AGRICULTURE & RURAL DEVELOPMENT IN PAKISTAN

the Keynote Address

The World Fertilizer Market & Its Impact on the CENTO Region

Dr. Victor L. Sheldon & Mr. John T. Shields

Fertilizer is well recognized as a major factor in increasing food production. It has become and still is the "backbone" of agricultural development programmes in many countries. Although the importance of fertilizer is well documented, probably at no time in history, including the prime years of the "Green Revolution", has the spotlight been more on fertilizer than it is today.

This seminar unfolds amidst universal concern and interest in global food scarcity and rising food prices. This is primarily the result of world grain reserves being drawn down to the danger point, possibly insufficient to sustain the world through a period of widespread drought or similar catastrophe. Such is the concern that developmental experts are now advocating the creation of an internationally managed world food bank as a means of maintaining some semblance of order and stability in the world food economy. (1)

The concern over potential global food scarcity is compounded when one considers that the current world fertilizer supplies are insufficient to meet the demand. The outlook for future supply adjustments are cloudy especially for nitrogen production. Numerous developmental organizations, such as the World Bank, Food & Agriculture Organization, Tennessee Valley Authority and country governments, are addressing themselves to the problem of trying to understand and resolve the present dilemma.

It is against this background that we appraise the world fertilizer situation and its probable impact on the CENTO region.

Experience dictates that any discussion of the world fertilizer market "today" will probably have to be revised "tomorrow" in order to reflect the rapidity and magnitude of changes that continually affect

the world fertilizer supply and demand. During the last decade, the pendulum has swung from a market of short supply and firm prices of the early 1960's to the chaotic market of overcapacity and falling prices of the late 1960's and now back to a market characterized by an upward movement of prices and a tight supply and demand situation with occasional spot shortages.

A brief review of past and recent world fertilizer developments may help to put the present market situation and its effect on the CENTO region in perspective. This paper draws heavily on data compiled and maintained at the National Fertilizer Development Centre (NFDC), especially TVA's most recent biennial world survey (2), plus several recent papers (3, 4).

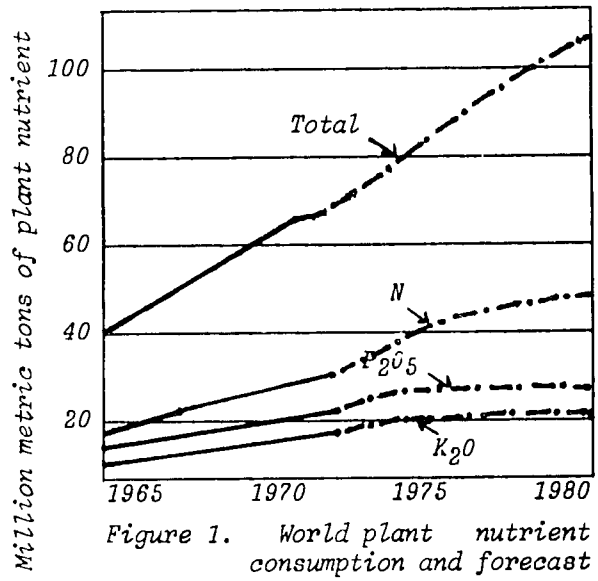


Figure 1. World plant nutrient consumption and forecast

World Fertilizer Demand

As illustrated in figure 1, world fertilizer use in 1972 was estimated at over 72 million metric tons (mt) of nutrients - nitrogen 33.7 million mt, P_2O_5 nearly 21 million mt, and K_2O at 17.5 million mt. TVA's projections for 1975 and 1980 are estimated to be in the range of 86 million mt and 106 million mt respectively. Thus, the expected annual increase between now and 1975 is about 6%, and 5% between now and 1980. This estimate is now being re-evaluated, especially in light of the increasing emphasis on replenishing and maintaining acceptable levels of world food grain reserves. It is conceivable that the 1974 TVA estimates for 1980 could approach 110 million mt of nutrient use if supporting institutional and market infrastructure is available.

During 1972 both nitrogen and phosphate products were in tight supply. Closer examination of the production data indicates that the major increases took place in the U.S.S.R. and China, while production in most free world countries either remained unchanged or declined. Thus, a tight supply situation developed as the large inventory buildup of the past few years was depleted and importing countries came back into the international market, only to find that the sellers had little to offer and that prices had recovered to the previous all-time highs achieved

during the early 1960's.

The reasons for this sudden change are complex but explainable. First, little new investment was attracted to the industry because of the low rates of return experienced during the last few years; alternative uses of capital looked better in other segments of the economy than expansion in the fertilizer industry. Secondly, numerous construction delays moved startup dates back for many plants that were anticipated during the 1971-72 fertilizer year and operating difficulties kept plant utilization rates well below the anticipated minimum level. Thirdly, many large producers had found new markets for their export production. Consequently, the needs of countries not in the market every year were not anticipated and supplies were not available. Manufacturers require advance time to adequately plan increases in production. Because of the magnitude of the world fertilizer industry, there is a fine line between a supply and demand balance and a surplus or deficit. The pendulum can swing quickly from one side to the other and go back just as fast as has already been demonstrated.

World Fertilizer Supplies

In 1972, TVA projected that world nitrogen (N) capacity and demand would follow parallel growth patterns through 1975. In 1971 total world N capacity was estimated at 53 million mt with a scheduled jump of 5 million mt for 1973. This increase was not forthcoming, either from construction delays or increased startup problems; as a result, total N fertilizer production reached just over 35 million mt rather than the predicted 36.3 million tons (table 1). The supply-demand ratio remained at 1.04 - well within the limit indicating a balanced market - and spot shortages began to appear.

TABLE I. World Nitrogen Production and Consumption for Selected Years

YEAR	N PRODUCTION	N CONSUMPTION	S/D RATIO
1965	17.3	16.3	1.06
1970	30.2	28.7	1.05
1972 (prel.)	35.1	33.7	1.04
1975*	43.1	41.0	1.05

* *Estimate assuming an operating rate of 90% in developed regions and 80% in developing regions.*

S/D Supply/Demand

The planned additional capacity has not been abandoned. Much of it will come on-stream between now and 1975. As a result, the world N capacity expected for 1975 of 67.8 million mt (table 2) remains as a guide to the medium term future market situation. The world N market should remain very close to a balance with firm prices but with supplies adequate to meet increased demand. There is now evidence that the improved price situation is stimulating new investment and that additional nitrogen capacity is being contemplated. However, these additions should not have a major impact on the world market before 1975.

TABLE 2. World Nitrogen Production Capacity

YEAR	TOTAL CAPACITY (million metric tons)	POTENTIAL SUPPLY*
1965	27.8	18.0
1970	48.4	30.3
1972	58.0	36.3
1975	67.8	43.1

* *Assuming an operating rate of 90% in developed regions and 80% in developing regions.*

It is difficult to establish a true world P_2O_5 capacity figure. Supply estimates, based on a combination of production estimates and capacity data for phosphoric acid, indicated that the world P_2O_5 market would achieve a balance in 1972; without further plant expansion or a significant improvement in operating rates, shortages would occur (table 3). This situation was due to the lack of expansion in the industry to cover any more than the decline in production of low-analysis materials. With greater amounts of phosphoric acid per unit of P_2O_5 being consumed, demand soon caught up with available supplies. While this movement toward the greater use of acid was occurring, several phosphoric acid plants in the United States were closed. Other plants suffered operating difficulties and new plants had prolonged startup problems. These factors led to a shortage of phosphoric acid, even with plants reportedly operating at 95% of capacity; products derived from phosphoric acid - triple superphosphate and diammonium phosphate - disappeared from inventories and the marketplace. Prices of phosphate materials rose sharply,

TABLE 3 World Phosphate Production and Consumption for Selected Years

YEAR	PRODUCTION (million metric tons)	CONSUMPTION	S/D RATIO
1965	14.7	13.7	1.07
1970	19.2	18.6	1.03
1972 (prel.)	21.7	20.9	1.03
1975*	22.0	24.3	.91

* *Estimate assuming an operating rate of 80% in developed regions and 60% in developing regions*

S/D Supply/Demand

bringing about the re-opening of some plants and a flurry of new plant construction plans. It now appears that the shortage of phosphate materials may be over for the present, but prices may remain firm well into 1974.

Raw Material Supplies

Certain factors on the horizon could restrict fertilizer industry growth. The first of these restrictive factors is *natural gas*. The world nitrogen industry is based primarily on natural gas as a feedstock and as an energy source. Natural gas has an almost unlimited demand. Although ammonia accounts for only a small percentage of gas use, the projected limited supply levels indicate that producers will pay more for the gas they use in the future and that they will have to operate with interruptible supplies and shortages. It is difficult to determine the exact position of gas supplies, but the following factors should be considered. First, since low price levels have limited exploration, it can be assumed that higher prices will revive new explorations and also increase activity in the area of transport facilities. Second, several areas of the world have large gas reserves and could supply deficit areas - with natural gas, ammonia, or nitrogen fertilizers. Third, there are major programmes under way to develop alternative energy sources,

such as synthetic gas or the use of the large reserves of low-sulphur coal. While these are long-term considerations, it should be remembered that short-supply situations are usually a short-lived phenomena unless artificial restrictions are imposed on the marketplace. Nitrogen fertilizers are vital to the world food situation; thus, while the gas situation may hurt in some places its overall effect will be minimized by the actions and reactions of a free marketplace.

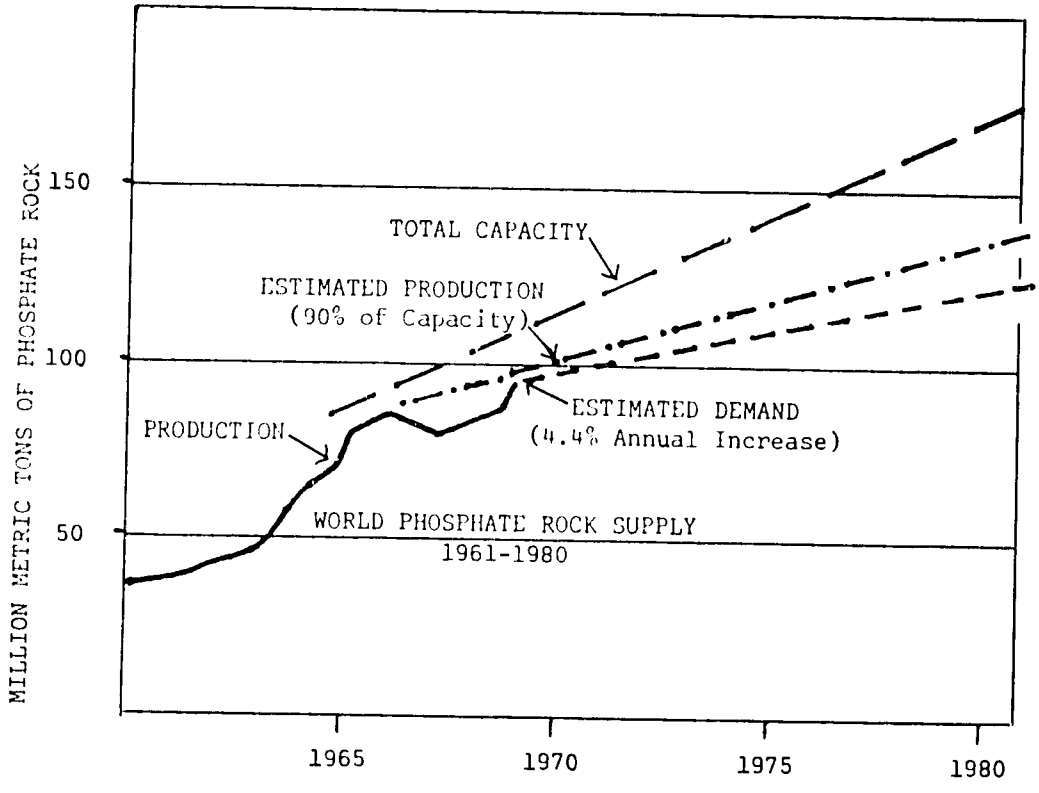
The second possible restriction to increasing fertilizer supplies in the short run could be *phosphate rock*. While large expansions in phosphoric acid capacity have been announced, few additions to rock mining capacity have been indicated. There has been a steady increase in total P_2O_5 production throughout the world but rock production has not kept pace. In the United States, for example, production reached a peak of 37.4 million mt in 1968. Estimates for 1972 show production at 37.0 million mt (5). In 1971 only 9 of the world's 15 major producing countries showed increased production over the previous year and in some cases the changes were minor. World output gained only about 6 million mt of rock between 1968 and 1971 (table 4) (6). Using an average of 33% P_2O_5 content, this represents about 2 million mt of P_2O_5 compared to a fertilizer production increase of almost 2.8 million mt of P_2O_5 (7). The large overproduction of phosphate rock in the late 1960's led to high inventory levels, very low prices and a delay in new mine additions and expansions. Now, demand is again approaching the available supply level and more rock mining capacity is needed. However, the additional cost of further exploiting existing mines will be considerably greater than in the past.

TABLE 4. World and Regional Phosphate Rock Production, 1968 and 1971

REGION	1968 (million metric	1971 tons of material)
North America	37.4	35.0
Africa	18.8	20.7
Asia	2.1	1.5
U.S.S.R.	14.8	20.1
WORLD TOTAL	79.6	84.9

Recent TVA projections of world P_2O_5 show consumption increasing at an average rate of 4.4% per year; thus, rock demand by 1980 should exceed 130 million mt. By 1980 planned additions to capacity (8) along with the assumed opening of several new mining areas - Australia, Spanish Sahara, Peru and possibly Angola - would bring the total capacity to over 155 million mt, well above the suggested demand. Bearing in mind that these are total capacity data and need adjustment for saleable production, we have used an operating rate of 90% of capacity - the level attained during 1967 and 1968 - to indicate supply. As shown in figure 2, supply is well above demand, but only if the proposed expansion materialize.

FIGURE 2.



The future of the potash market will be one of restricted production levels for some time to come. Total K_2O consumtpion reached 17.5 million mt in 1972 as potash continued its steady growth rate (figure 3). But total world potash capacity remained at 26 million mt with only 19 million mt being produced. With most of this overcapacity centered in Canada, it is to be expected that production restrictions will continue with adjustments made as demand levels increase. While no shortage of material should exist, the result of these controls will mean a stable market with price changes reflecting changes in production and distribution costs. While potash reserves occur in all regions of the world, 94% of the production is in North America, Western and Eastern Europe.

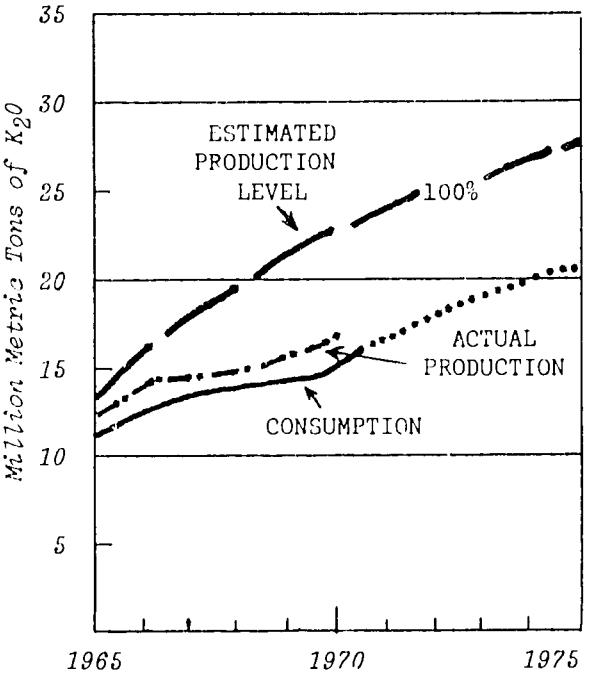


FIGURE 3. World potash market situation(2)

Product Trends

The world and regional fertilizer production picture has undergone significant changes in the past 10 years and even more significant changes can be expected in the next decade. Low-analysis fertilizers are continuously being replaced by higher analysis materials. Ammonium sulphate and ammonium nitrate are losing ground to urea and in some areas to anhydrous ammonia and nitrogen solutions.

Single (normal) superphosphate is being replaced partly by concentrated superphosphate (CSP) and to a greater extent by high-analysis complex fertilizers of the nitrophosphate or ammonium phosphate types. Anhydrous ammonia has become the basic building block for nitrogen fertilizers while wet-process phosphoric acid is now the prime intermediate source of phosphate. Little change has taken place in potash production; muriate of potash (KCl) is the principal type of potash fertilizer.

Indicative of these changes in production and use are the patterns that are evolving in world and regional fertilizer trade. In 1971/72 nearly 30% of the world fertilizer consumption was exported. The rise of urea, a major nitrogen fertilizer, has had a significant impact in the world market. Urea now accounts for nearly 20% of world nitrogen production and over 33% of the world nitrogen exports. Even more significantly, by 1975 urea capacity will account for 50% of total world nitrogen product capacity (figure 4) with the major shift taking place in the developing regions. By 1975 it is expected that three-fourths of all nitrogen product capacity will be in these regions if plants are brought to completion as scheduled. The Asian nations are leading this shift to urea by scheduling over 80% of their planned product nitrogen capacity by 1975 as urea.

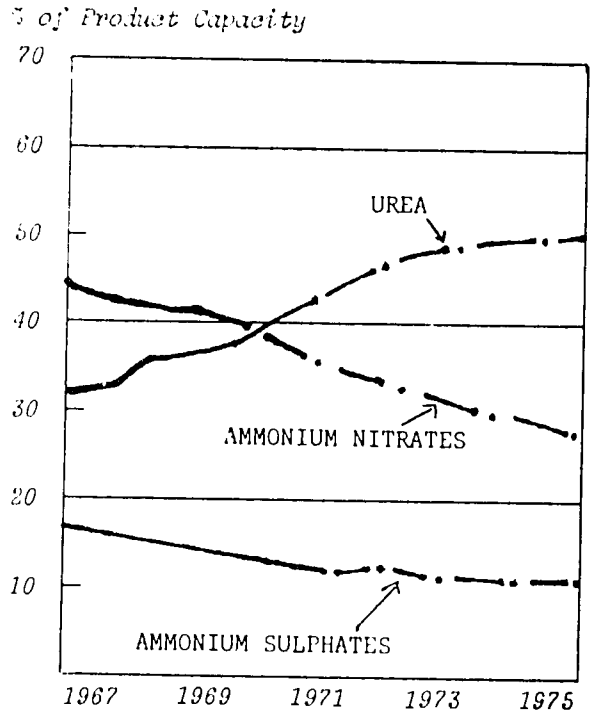


FIGURE 4. Relative importance of selected nitrogen materials (2)

In terms of phosphate fertilizers, the significant development has been the increased production and use of fertilizers including the ammoniated phosphates such as diammonium phosphate (18-46-0) (figure 5). Although over 80% of the total P_2O_5 capacity is in the developed regions of the world, the developing regions are gradually increasing their P_2O_5 capacity primarily in the form of complex fertilizers based on wet-process phosphoric acid. With the development of new technology in the ocean transport of phosphoric acid and since production economics favour large-scale plants near raw material sites, expanded trade in phosphoric acid is contemplated.

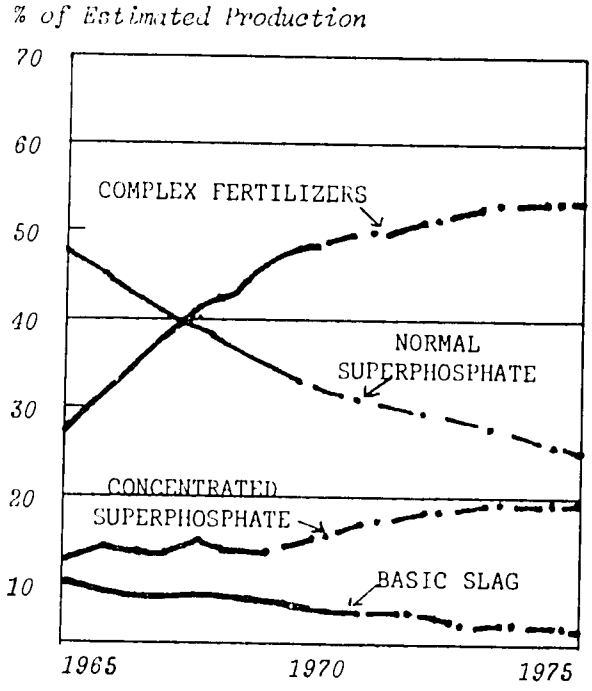


FIGURE 5. Relative importance of selected phosphate materials (2)

Price Developments

The changing world supply/demand situation along with shifts in marketed products has had its effect on international prices. Beginning with mid-1971, F.O.B.* prices for the major traded fertilizer materials began to move upward and by the end of the first quarter of 1972 prices of nitrogen products had risen 10% to 20% and by the end of the year further increases of 40% to 50% had been recorded. Since mid-1971, urea prices have risen from $55 F.O.B. to about $110 F.O.B. in mid-1973, while diammonium phosphate has risen from $70 F.O.B. to over $120 F.O.B. during the same period. Concentrated superphosphate prices have experienced the steepest rise, moving from about $47 in mid-1971 to over $110 through the second quarter of 1973 (Figure 6). While these prices represent U.S. shipments, they also reflect price trends of Japan and Western Europe.

Prices of potash fertilizers have been rising since 1970, after having fallen to low levels following the opening of a number of new mines in Saskatchewan, Canada. European producers raised the price of potash salts by about 10% in 1972. This was the third increase in three years, and brought prices in line with those of the North American industry, which in January 1970 had imposed an increase of about $10 per mt. At the same time, the Saskatchewan Government had raised the price of potash from the extreme low of $10 (Canadian) per short ton of K_2O ex-mine to a floor of $33.75 (Canadian) by imposing a quota on production and prorating it among producers in the province. This floor price has since remained unchanged but, owing to increased rail freight and other charges, quotations for 1973 sales have been $35 to $36 per mt F.O.B. Vancouver (9).

While prices of finished product have been rising, raw material and intermediate prices have also increased. Ammonia prices have risen from under $40 F.O.B in 1971 to approximately $65-$66 F.O.B in mid-1973. Phosphate rock and phosphoric acid have also moved upward during the past year.

In conjunction with the changing fertilizer supply and price situation, have been adjustments in international currency values. For countries which traditionally quote export prices in dollars, the dollar devaluation of 1971 and 1973 could, in effect, reduce returns and may result in further compensatory price increases.

CENTO Region

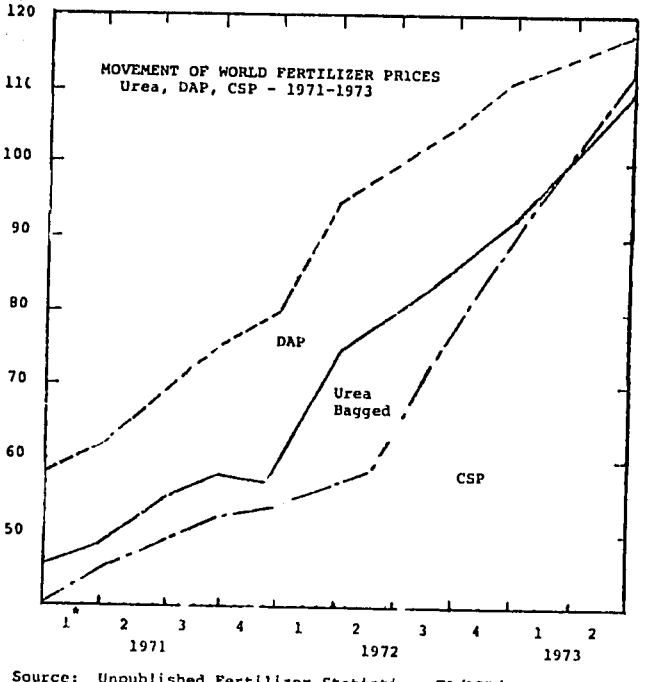
Now, the paramount question, what is the impact of the current world fertilizer situation on the CENTO region? Obviously, the situation

* *Freight on board*

is complex and it is extremely difficult to draw definite conclusions. Add to this the fact that the agriculture and fertilizer conditions in the countries comprising the region are extremely heterogeneous and the task of evaluating the impact is done with considerable risk of being in error.

Situation - In 1971/72 over 912,000 mt of fertilizer nutrients were consumed in the region (figure 7). Turkey accounts for 52% of regional consumption, Pakistan 29% and Iran 19%. The total regional consumption represents about 1.3% of world consumption; however, the region imported nearly 5% of the total world nitrogen traded in 1972. More important is the fact that the countries imported nearly 50% of the total fertilizer consumed in the region. Turkey imports between 60% and 80% of its annual fertilizer requirements while Pakistan depends on imports for roughly one-third of its annual consumption. Over two-thirds of the fertilizer used in the region is in the form of nitrogen products.

FIGURE 6



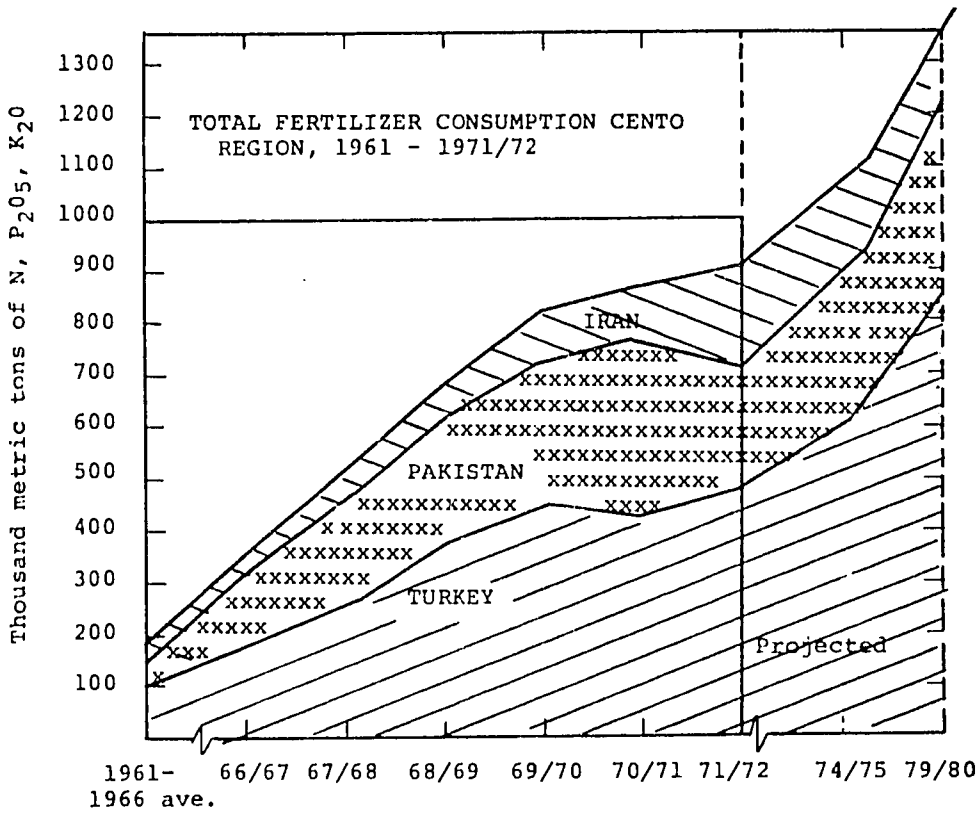
Source: Unpublished Fertilizer Statistics, TA/AGR/AID Washington, D.C.

*By quarters

Future Growth Potential - The fertilizer market of any country or region grows and is sustained by two dimensions - fertilized hectarages and rates of application. Papers to be presented in later sessions of this seminar will deal specifically with these two dimensions; however, some general comments on land/fertilizer/crop yield relationships may serve to illustrate the relative importance of fertilizer use on crop yields in estimating effective demand.

Per hectare consumption estimates can be misleading statistics; however, they can also demonstrate the significance of higher levels of fertilizer use on food production. Figure 8 illustrates the effect of fertilizer use on rice yields. With 150 to 300 kg of N, P_2O_5, K_2O per hectare, Japan, Taiwan, and Jorea are able to obtain 3.5 to nearly 6 mt of rough rice per hectare. In 1971/72 Pakistan, Turkey and Iran consumed approximately 15, 16 and 6 kg of nutrients per hectare respectively for all crops.

FIGURE 7



There can be no doubt that fertilizer consumption per planted hectare in the region must increase significantly if food production is to keep pace with population growth. Unfortunately, such objectives require large capital expenditures whether for domestically produced or imported fertilizers.

A reasonable 1980 "effective demand" estimate for the region appears to be in the area of 1.5 to 1.8 million mt of nutrients. This represents a 40% to 50% increase in consumption. Growth rates, no doubt, will vary within the region with Pakistan likely to achieve much higher growth rates than either Turkey or Iran.

What is the capability of each country to meet its future fertilizer requirements? First, let's look at nitrogen. Evaluation of existing and projected nitrogen fertilizer capacity in the three countries indicates that by 1975 the region will have approximately 1.0 million mt of nitrogen capacity and 1.5 million mt by 1980 (table 5). Translating this capacity into supply estimates after allowing for losses and industrial

TABLE 5. Estimated Nitrogen Fertilizer Supply/Demand for the CENTO Region, 1975 and 1980

YEAR	TOTAL NITROGEN CAPACITY*	NITROGEN SUPPLY°	NITROGEN DEMAND	SURPLUS OR DEFICIT
1972	859,000	474,000	613,000	- 139,000
1975	1,062,000	590,000	807,000	- 217,000
1980	1,500,000	978,000	1,107,000	- 208,500

* *Factor of 80%*
° *Considers loss factor of 10% and industrial use of 10%.*

Source: *Based on estimates calculated from TVA's worldwide capacity data bank, by Distribution Economics Section.*

use, the region would have approximately 590,000 mt of nitrogen supply in 1975 and nearly 1.0 million mt by 1980. This means that the region would continue to be deficit in nitrogen through 1980, although Iran would be in a surplus situation and thus be a potential net exporter of nitrogen products.

By 1975 and 1980 nitrogen capacity in the region should be fairly well distributed among the countries with Iran having nearly 40% of the capacity (table 6) but Pakistan and Turkey will have over 80% of the regional nitrogen demand.

TABLE 6. Nitrogen Capacity in the CENTO Region, 1975 and 1980.

	IRAN	PAKISTAN	TURKEY	TOTAL
		- 000 mt -		
1975	302	346	403	1,062
(%)	(28)	(33)	(39)	
1980	574	522	413	1,500
(%)	(38)	(35)	(27)	

In terms of P_2O_5 capacity, the region was deficit by approximately 54,000 mt based on the assumption of an 80% production factor. However, we know that over 130,000 mt of P_2O_5 were imported in the region primarily because of low capacity utilization in Turkey. Looking ahead, the region could be surplus in 1975 and then deficit again in 1980 (table 7). If Turkey could achieve 80% capacity utilization during the latter 1970's, it would be surplus in P_2O_5 assuming the demand estimates are correct.

TABLE 7. Estimated P_2O_5 Supply/Demand for the CENTO Region 1975 and 1980

YEAR	TOTAL PHOSPHATE CAPACITY*	PHOSPHATE SUPPLY°	PHOSPHATE DEMAND	SURPLUS OR DEFICIT
1972	409,000	233,000	287,000	- 54,000
1975	667,000	529,000	402,000	127,000
1980	667,000	616,000	625,000	- 9,000

* *Expressed as phosphoric acid capacity.*
° *Assumes 80% production capacity and 6% loss factor.*

Such conclusions relative to future regional nitrogen and phosphate supplies suggest possible interregional fertilizer trade as a means of meeting individual country fertilizer requirements. This could result in critical foreign exchange savings especially for Pakistan and Iran. Turkey may be somewhat disadvantaged unless the Suez Canal is re-opened.

Critical to fertilizer supply in the region in the latter 1970's will be the capability of the fertilizer industry to operate at or near capacity levels.

Failure to obtain adequate supplies of phosphate rock and ammonia will limit production capability as will-power and gas interruptions.

Import requirements should be determined and solicited at least a year in advance of need and fertilizer-crop price relationships should continually be evaluated in view of higher import prices.

In a seller's market, we sometimes forget that the importance of marketing and distribution is not diminished but *enhanced*. In times of short supplies and higher prices, the responsibility of reducing cost and *improving efficiency* lies within the marketing channel.

Hopefully, during the course of this seminar we will gain insights into solving problems and exploiting opportunities for improving fertilizer marketing, distribution, and use in the CENTO region.

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Dr. Sheldon is a professor of Agriculture at the College of Applied Sciences at the Western Illinois University at Macomb. Mr. Shields is an Agricultural Economist with the International Fertilizer Development Staff of the Tennessee Valley Authority in Muscle Shoals, Alabama.

I. Fertilizer Marketing Systems in the CENTO Region

Fertilizer Marketing, Distribution and Use in Turkey

Mr. Sezai Bayraktar

The world's population has been increasing very quickly in the last 20 years; from 2.5 billion in 1952 to 3.5 billion in 1972. In parallel with this, Turkey's population with an increasing rate of 100% in the last 20 years has reached 35 million. If the population growth goes on increasing with such a high rate as 2.5%, Turkey's population is estimated to be 75 million in 2000.

The problem of nutrition has started to show up with the growth of population. Many more agricultural products are needed to meet the food requirements. Agricultural production can be increased in two ways. One way is increasing the cultivated area, the other way is increasing the yield. The second way is impossible now in Turkey, because the forests and meadows have been used as fields with no concern for the weather and soil conditions. This is being prevented now. Even so, the only way to increase the agricultural production is by increasing the yield.

One of the most important factors of increasing the yield is using fertilizer. Fertilizer application, together with other factors, is 50% effective in increasing the yield.

I PRESENT SITUATION

35% of the fertilizers used in Turkey is produced domestically and the rest is supplied by imports. The fertilizer supply and consumption situation in the First and Second Five Year Plan Periods is given in Table 1. As it is seen in the table, production and imports increased parallel to increased fertilizer consumption. As the increase in domestic production is lower than the consumption, the rate of imports has increased.

A PRODUCTION

Although there is a vast area for fertilizer consumption in Turkey, there hasn't been a rapid development in the fertilizer industry.

Present domestic fertilizer production is being carried out by the following agencies. Their present and proposed activities are shown below:

Karabük Is the oldest plant in our fertilizer industry. It is not essentially a fertilizer producer and uses only the by-products of the steel industry of the Turkish Iron and Steel Mill Corporation, therefore, its production continues on a small scale. Production is 8000 tons of ammonium sulphate and 3000 tons of superphosphate per year.

The Fertilizer Industry C. (GÜBRE FABRİKALARI T.A.Ş.), is the second oldest in Turkey. It produces superphosphate. There are two plants, one located in İzmit and the other in İskenderun; both have 120,000 metric tons optimal capacity. The İskenderun plant was converted to triple superphosphate (T.S.P) in 1968.

The Nitrogen Co. (AZOT SANAYİİ T.A.Ş) is a fully government-owned organization and has three plants.

- Kütahya Plant; produces 80,000 tons of ammonium sulphate (21%N) and 60,000 tons of ammonium nitrate (26% N) per year.

- Samsun Plant; presently produces 220,000 tons of triple superphosphate and will produce 139,500 tons of diammoniumphosphate (D.A.P) per year.

- Elazığ Plant; produces 220,000 tons of superphosphate per year.

The Mediterranean Fertilizer Co. (AKDENİZ GÜBRE SANAYİİ A.Ş.) presently produces 594,000 tons of ammonium nitrate (26% N) and 148,500 tons of diammoniumphosphate per year.

The Bandırma Fertilizer Co. (BANDIRMA GÜBRE FABRİKALARI A.Ş.) started producing this year and will produce 200,000 tons of superphosphate.

The Fourth Fertilizer Industry Plant is still under negotiation and investigation. Its actual location, capacity and production has not yet been determined. This plant will be on the Aegean Coast, hopefully producing 400,000 tons TSP and 550,000 tons nitrogenous fertilizer.

Istanbul Fertilizer Industry Co. (İGSAŞ) will start producing in 1976, with 270,000 tons of urea per year from ammonia. This plant will be financed by the World Bank.

Gemlik Plant will start producing in 1975 and will produce 594,000 tons of ammonium nitrate (26% N) per year.

Potassium fertilizer production has not yet started in Turkey. Turkish soils are generally rich enough in potassium. For this reason the demand is still low and the whole amount will be imported.

B *IMPORT*

Turkey's domestic production cannot meet the country's demand, so it has become necessary to import.

1. *Fertilizer Consumption:*

Fertilizer usage is very new in Turkey. Consumption began to increase in 1960 and increased rapidly during the First Five Year Plan Period starting in 1963.

Fertilizer consumption in Turkey is given in Table 3, which shows fertilizer consumption increased 50 times in this period. The increasing rate has been higher in 1963-72 period.

Fertilizer consumption was very low in 1950-1963 before the Plan Period. After 1963, fertilizers were given much importance in development plans with great efforts to increase the usage. Due to these efforts the consumption of plant nutrients increased to 647,782 tons in 1972 while it was 86,922 tons in 1963. However, this increase is less than those for other countries. (Table 4)

Plant nutrient consumption per hectar in Turkey and some other countries is given in Table 5.

II DISTRIBUTION AND MARKETING SYSTEM

A *FORMALITIES AND ORGANIZATION*

Fertilizer imports, the purchasing of domestic production and distribution throughout the country, has been carried out by Government orders since entering the Plan Period. The Agricultural Supply Organization was given the duty of supplying and distributing fertilizers by a Government order in 1962. In later years the Sugar Monopoly, the Agricultural Credit Co-operatives, other agricultural co-operatives and the private sector have taken part in supply and distribution. But having so many organizations and persons involved in supply and distribution causes many problems. First of all, it wasn't possible to establish co-

ordination among the organizations; it wasn't possible to supply the fertilizers on time and it was obvious that the private sector worked only for commercial purposes.

For these reasons, all concerned organizations except the Agricultural Supply Organization, the Sugar Monopoly and the Agricultural Credit Co-operatives were banned from operation in 1972 by a Government order.

After a year of this system, some problems evolved. The world's fertilizer prices increased greatly, while the fertilizer prices stayed stable in Turkey. So the fertilizer supplying organizations faced great losses. The Agricultural Supply Organization and the Sugar Monopoly, being Government establishments, received subsidies from the Government, and were able to carry on their work. But the Agricultural Credit Co-operatives, having no subsidies, had to drop the supply and distribution works, and this situation was approved by a Government Order dated 23.5.1973.

Supply and distribution works are being done by the Agricultural Supply Organization and the Sugar Monopoly at the present.

The whole country's demand is imported by these two organizations. The factories sell their products to these two organizations and they distribute the imported and domestically produced fertilizers throughout the country.

The present supply and distribution system of Turkey is given in Figure 1.

The Government Order, which is still effective, gives the following duties to the Ministry of Agriculture: co-ordinating the organizations, preparing the supply programmes, establishing the amounts of fertilizers to be imported and the shares of the organizations from domestically produced fertilizers and deciding the distribution time, amount and place of the fertilizers.

The Agricultural Supply Organization carries out the work with the regional and sectional Directorates, agencies and salesmen under contract, while the Sugar Monopoly carries out the work within its own agricultural organization. The Agricultural Supply Organization has 21 regional and 5 sectional directorates, 177 agencies and 2013 salesmen under contract; and as sales agents, 2039 agricultural co-operatives.

B PRICE

In Turkey the fertilizer prices are determined by Government or-

ders. The retail sales prices of some fertilizers in 1963-72 period are given in Table 6. The table shows that the current fertilizer prices were the same during 1963-64.

C FINANCING

In order to meet the financial requirements of the supply and distribution organizations and the fertilizer credits to be given to farmers, a Fertilizer Fund was formed with the Turkish Agricultural Bank.

D RESEARCH - TRAINING - EXTENSION

In Turkey, these activities are carried out by the Agricultural Faculties, the Ministries of Agriculture, Village Affairs, Industry and Commerce. The goals of these activities are:

- To determine the necessary criteria for the usage of fertilizers under the most economic conditions considering the climate, soil and water conditions.

- To extend the results of agricultural research into practice.

- To recommend fertilizers according to soil analyses.

- To increase the farmers' knowledge of fertilizer usage.

III CONSUMPTION AND PRODUCTION GOALS

A CONSUMPTION GOALS

The results of research and experiments are used as a basis for estimating the future fertilizer requirements and usages of Turkey. They also determine the fertilizer doses for various crops.

The fertilizer requirement estimates during the 1973-1982 period are given in Table 7. As can be seen from the table, the requirement increases year by year and reaches 866,200 tons in nitrogenous, and 726,900 tons in phosphate fertilizers.

B PRODUCTION GOALS

The productions and capacities of the present factories in Turkey are given in Table 2.

The nitrogenous fertilizer production capacity is 317,218 tons per year and the phosphate fertilizer production capacity is 370,578 tons per year in 1972. This amount will increase up to 521,909 tons of nitrogenous and 494,015 tons of phosphate in 1977. In 1982 the nitrogenous fertilizer will increase up to 642,386 tons and the phosphate fertilizer up to 529,942 tons per year.

It is calculated that with fertilizer complexes entering the circuit, the fertilizer deficit will decrease and production will increase.

If the production and consumption goals are compared, Turkey's fertilizer deficit will be zero during the years 1975-76-77 if new projects do not make the deficit grow.

Mr. Sezai Bayraktar is a Technician in the Plant Nutrition Section of the General Directorate of Agricultural Affairs, Turkey.

TABLE : I

THE IMPLEMENTATION OF FERTILIZER PROGRAMME FROM 1963 - 1972

Unit: 1,000 tons nutrient

Years	Type	Stock	Production	Import	Total	Usage	Target	Per cent of realization according to Supply	Per cent of realization according to Plan
1963	N	24	30	7	61	39	35	63	111
	P205	7	30	14	51	37	47	72	78
	K20	-	-	11	11	11	11	100	100
	TOTAL	31	60	32	123	87	103	70	84
1964	N	22	33	10	65	54	50	83	108
	P205	15	27	14	56	45	60	80	75
	K20	-	-	5	5	5	12	100	42
	TOTAL	37	60	29	126	104	122	83	85
1965	N	12	33	32	77	74	65	96	114
	P205	11	38	49	98	77	88	78	87
	K20	-	-	5	5	5	15	100	33
	TOTAL	23	71	86	180	156	168	86	93
1966	N	4	33	69	107	98	84	92	116
	P205	22	38	62	122	93	93	76	100
	K20	-	-	6	6	6	15	100	40
	TOTAL	26	71	137	235	197	192	84	102
1967	N	8	33	112	153	142	126	93	112
	P205	28	35	122	185	143	181	77	79
	K20	-	-	8	8	8	18	100	44
	TOTAL	36	68	242	346	293	325	84	90
1968	N	11	35	167	213	193	189	90	102
	P205	44	51	202	297	200	272	67	73
	K20	1	-	10	11	10	20	91	50
	TOTAL	56	86	379	521	403	481	77	84
1969	N	20	53	213	286	245	336	85	73
	P205	96	46	137	279	214	306	77	70
	K20	1	-	12	13	12	20	92	60
	TOTAL	117	99	362	578	471	662	81	71
1970	N	41	82	151	274	243	378	88	64
	P205	66	66	78	210	176	340	84	51
	K20	-	-	13	13	13	23	100	56
	TOTAL	101	148	242	499	432	741	86	58
1971	N	35	75	198	308	287	378	93	76
	P205	42	105	77	224	195	340	87	57
	K20	1	-	14	15	13	23	86	56
	TOTAL	78	180	289	547	495	741	90	67
1972	N	21	146	344	511	374	378	73	99
	P205	30	125	136	291	246	340	84	72
	K20	2	-	30	32	27	23	84	117
	TOTAL	53	271	510	834	647	741	77	87

Source: Ministry of Agriculture

TABLE : 2

THE PRESENT CAPACITY OF FERTILIZER FACTORIES AND PRODUCTION CAPACITY RATIO

	CAPACITY		PRODUCTION		PRODUCTION/CAPACITY %	
	Nitrogenous	Phosphate	Nitrogenous	Phosphate		
Years	21% N	16-18% P205	21% N	16-18% P205	N	P205
1963	148,500	627,000	145,000	180,000	97.6	28.7
1964	148,500	627,000	161,000	156,000	108.4	24.8
1965	148,500	627,000	155,134	223,934	104.4	35.7
1966	148,500	627,000	157,147	222,454	105.8	35.4
1967	148,500	627,000	154,707	206,350	104.1	32.9
1968	568,240	627,000	166,135	297,163	29.2	47.4
1969	568,240	627,000	249,901	273,362	43.9	43.6
1970	568,240	627,000	388,387	396,683	68.3	63.2
1971	687,791	1,778,050	355,801	621,411	51.7	35.0
1972	1,557,556	2,179,000	696,731	734,277	44.7	34.0

Source: DPT - 1171 - ÖİK 143 - Fertilizer Industry

TABLE : 3

FERTILIZER CONSUMPTION IN TURKEY

Unit: Metric Ton Plant Nutrient

Years	N	P205	K20	Total
1950	6,071	2,233	35	8,339
1951	4,169	3,829	106	8,104
1952	5,656	2,330	3,359	11,345
1953	9,727	5,291	2,563	17,581
1954	4,426	6,876	10,330	21,632
1955	11,023	14,347	647	26,017
1956	9,214	4,402	6,146	19,762
1957	10,133	5,728	-	15,861
1958	9,711	4,103	-	13,814
1959	24,862	9,864	-	34,726
1960	9,682	10,185	679	20,546
1961	29,416	13,095	15	42,526
1962	37,882	17,777	5,239	60,898
FIRST FIVE YEAR PLAN PERIOD				
1963	39,235	37,187	10,500	86,922
1964	54,202	45,068	4,600	103,870
1965	73,555	76,877	5,375	155,807
1966	98,308	92,913	5,740	196,961
1967	141,926	143,658	7,500	293,084
SECOND FIVE YEAR PLAN PERIOD				
1968	193,058	200,242	10,130	403,430
1969	245,264	213,747	12,065	471,076
1970	243,089	176,006	12,700	431,795
1971	286,762	194,737	13,247	494,746
1972	374,503	246,106	27,173	647,782

Source: Ministry of Agriculture

TABLE : 4

FERTILIZER CONSUMPTION IN EEC, RCD AND SOME EUROPEAN COUNTRIES

1970/1971

Unit: Nutrient Ton

Country	N	P205	K20	Total
Italy	594,547	518,418	225,290	338,255
France	1,453,446	1,809,390	1,388,815	4,651,651
West Germany	1,130,822	913,095	1,184,580	3,228,497
Greece	200,639	118,472	17,540	336,651
Rumania	366,900	203,200	24,200	594,300
Spain	540,100	428,600	205,975	1,174,675
U.K.	800,100	542,600	533,800	1,876,500
Yugoslavia	293,602	182,348	155,510	631,460
U.S.S.R.	4,605,000	2,211,000	2,574,000	9,390,000
Iran	58,000	37,000	2,500	97,500
Pakistan	352,200	65,527	11,656	429,383
Egypt	300,000	45,000	1,400	346,400
Turkey	243,089	176,006	12,700	431,795

Source: FAO Annual Fertilizer Review 1971

TABLE : 5

FERTILIZER CONSUMPTION PER HECTAR IN TURKEY AND OTHER COUNTRIES (1970/1971)

Unit: Kg/Hα.

Country	N	P205	K20	Total
Italy	39.8	34.7	15.1	89.6
France	75.4	93.9	72.1	241.4
West Germany	140.0	113.1	146.7	399.8
Greece	55.3	32.6	4.8	92.7
Rumania	34.9	19.3	2.3	56.5
Spain	26.2	20.8	10.0	57.0
U.K.	110.2	74.7	73.5	258.4
Yugoslavia	36.6	22.7	19.4	78.7
U.S.S.R.	19.8	9.5	11.1	40.4
Iran	3.5	2.2	0.2	5.9
Pakistan	12.4	2.3	0.4	15.1
Egypt	105.5	15.8	0.5	121.8
Turkey (1972)	19.9	13.0	1.4	34.3

Sources: FAO Annual Fertilizer Review 1971.

TABLE : 6

RETAIL PRICES OF FERTILIZERS BY YEAR IN TURKEY (Kruş/Kg.)*

Type of Fertilizer	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Ammonium Sulphate	63	63	63	59	59	54	54	60	60	60
Ammonium Nitrate (21% N)	60	60	60	56	56	54	54	60	60	60
Ammonium Nitrate (26% N)	-	-	-	-	75	65	65	71	71	71
Single Superphosphate	45	45	45	41	37	37	37	45	45	45
Triple Superphosphate	98	120	110	100	95	85	85	104	104	104

* 100 Kuruş = 1 TL, 13.50 TL = $1.00 as of May 1974.

Source : Ministry of Agriculture

TABLE : 7

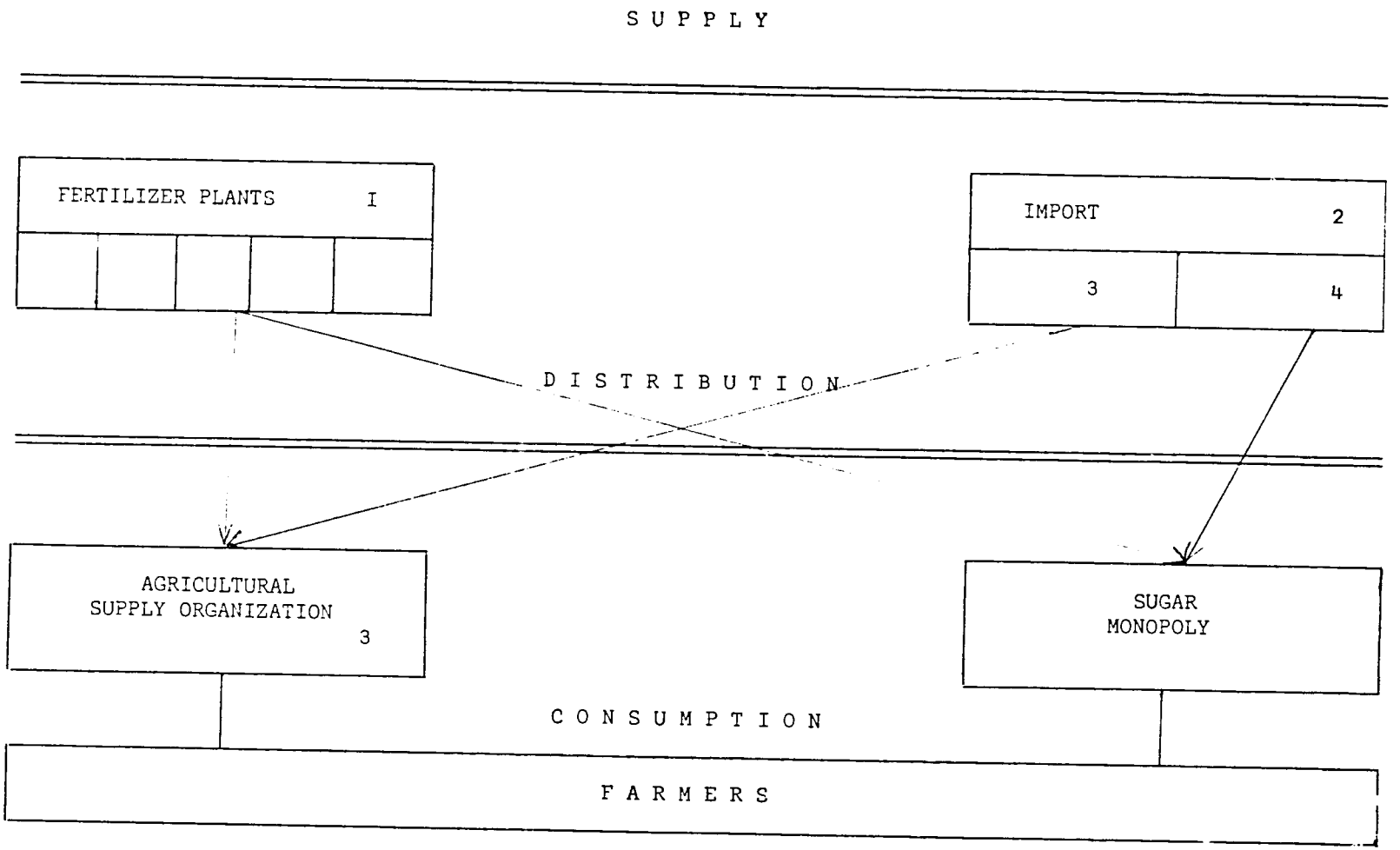
ESTIMATED FERTILIZER DEMAND FROM 1973 TO 1982

Unit: 1,000 Metric Ton Plant Nutrient

Years	N	P205	K20	Total
1973	462.5	397.7	13.6	873.8
1974	510.5	433.6	14.3	958.4
1975	558.5	469.3	15.0	1,042.8
1976	606.5	505.2	15.7	1,127.4
1977	654.4	541.2	16.4	1,212.0
1978	696.7	578.3	18.4	1,293.4
1979	739.2	615.4	20.3	1,374.9
1980	761.5	652.7	22.3	1,436.5
1981	824.2	689.8	24.2	1,538.2
1982	866.5	726.9	26.2	1,619.6

Source : Fertilizer Industry DPT - 1171 - ÖİK - 143

FIGURE : I


SUPPLY
FERTILIZER PLANTS I
IMPORT 2
3
4
DISTRIBUTION
AGRICULTURAL SUPPLY ORGANIZATION 3
SUGAR MONOPOLY
CONSUMPTION
FARMERS

Some Economic and Institutional Aspects of Fertilizer Marketing in Pakistan

Dr. Mohammad Aslam Chaudhry

From a theoretical standpoint, the broadest concept of marketing is any activity which actualizes a potential relationship of exchange between the makers and users of economic goods and services. The channel of distribution comprises a set of institutions which perform all the activities utilized to move a product and its title from production to consumption. An analysis of the channel structure would, therefore, involve the character of the link between fertilizer production and consumption as well as trace out the movement of ownership through the market channel. The relative simplicity of the fertilizer distribution channel in Pakistan can be attributed to the primary stages of the fertilizer market and the low degree of impact made by new technical knowledge on the market organization.

The ownership and control channel for chemical fertilizers has been characterized by a great degree of instability since the very inception of fertilizer use in Pakistan. Through the process of trial and error the Government of Pakistan has changed the ownership of agencies in fertilizer and inter-agency distributive shares. A gradual transfer of ownership has taken place to meet the growing needs of the fertilizer market over a wider and wider geographic area with the attendant problems of storage and transportation. The fertilizer distribution system must, therefore, evolve gradually from organizational simplicity towards complexity if better service to the farmer is to be provided and fertilizer use further expanded. The addition of new production lines and increased service to the farmer is likely to lead to organizational complexity which is a direct consequence of the fertilizer market channel evolution. In the recent past, the sellers' relation to the farmer has been divergent because of the concentration of fertilizer supply at a few production points and the wide dispersion of low income farm consumers whose level of per capita fertilizer use is very low. In contrast, the relationship of the farmer to the fertilizer supplier is supposedly convergent. A sequence of fertilizer distribution patterns over the last decade and a half in Pakistan indicates that the ownership of fertilizer

distribution has changed from absolute monopoly by the government to a mixture of public and semi-public distribution agencies.

THE IMPORTANCE OF FERTILIZER USE

The widespread use of inorganic fertilizers on agricultural lands has been necessitated by the fact that it is a low-cost and relatively elastic supply input as compared to traditional organic manure which is presumably of high cost and inelastic in supply response. Statistical evidence indicates that farmyard manure contains 0.5 per cent nitrogen - this implies that one ton of farmyard manure will contain 11.2 pounds of nitrogen or two carts of it will contain nutrients equal to one bag of ammonium sulphate. (1) Thus our total available supply of cow dung which is estimated at 311 million tons, yields 16 million nutrient tons of nitrogen. (2)

Increased fertilizer use has been a major factor in increasing the crop yields in many technologically advanced countries. In the United States alone, almost one half of the measured increase in crop yields from 1940 to 1955 can be attributed to the intensive use of fertilizers. (3) The contrast among various countries in pounds of nitrogen used per acre of cultivated land and per capita is very evident. The United Kingdom uses twenty-eight times as much nitrogen per acre of land as Pakistan; Japan twice as much as the United Kingdom, and the Netherlands nearly twice that of Japan. (4) It has been noticed that in spite of the intensive use of agricultural inputs in developed countries, the marginal rate of return from investments in fertilizer has continued to be substantially higher than those from investments in other farm inputs. A study carried out in the U.S.A. showed that the ratio of the value of the marginal product to the unit cost for fertilizer is 5.0, 4.2 and 4.0 times as high as that for labour, land and buildings respectively, and

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1. *Department of Animal Husbandry, Lahore.*

2. *See Appendix I*

3. *Zvi Griliches, "Sources of Measured Productivity Growth. U.S. Agriculture 1960-66," Journal of Potential Economy, LXX, Nos. 1-4 (1963) pp. 331-46.*

4. *(i) F.A.O. "Production Yearbook", Rome, 1966.*
   (ii) United Nations "Fertilizer Manual", New York, 1967.

for other similar farm inputs in the agricultural sector.[5] Similar previous studies carried out in the United States indicate a persistantly high marginal product-to-unit ratio of fertilizer which is an indication of a relatively higher rate of innovation and technical change in the production, distribution, and use of fertilizer.[6] Thus it is apparent that only those inputs will be increasingly used that have a higher benefit cost ratio relative to others over the time horizon of individual producing units. The importance of fertilizer in enhancing agricultural productivity in Pakistan can be well assessed from the fact that it ranks second only to irrigation water as an explanatory variable for increased agricultural growth. The Pakistan Planning Commission attributed 25 per cent of the gross value added to the crop output to increased fertilizer use during the Second Five Year Plan (1965-70). In addition to the general continuously rising trend of the demand for fertilizers in Pakistan, the emergence of new, highly responsive dwarf varieties in crops has caused a major shift in the level of crop output. That the chances of fertilizer use have greatly improved are verified by a favourable crop response from Mexi-Pak seeds. This wheat is estimated to yield 15-30 pounds for one pound of nutrient under commercial conditions as compared to 8 pounds of increased grain for each pound of N and P_2O_5 (nutrient basis). The top experimental yield of Irri rice has been estimated at 164 bushels per acre as compared to 30 bushels for an average commercial yield of local varieties. Similarly, the introduction of J-1 - a synthetic maize - on a limited commercial basis, gave a yield of 60-100 bushels per acre.[7]

EXISTING FERTILIZER MARKET ORGANIZATION

In the recent past, the fertilizer market channel was organized around five major public, semi-public and private distribution agencies (i.e. ESSO, PNO, ADC, RSCC and Dawood Corporation, etc.) whose unit channels of distribution maintained a long chain of wholesalers and retailers whose loyalities tended to switch from time to time. The instability in retailing business grew partly from the satisfying rather

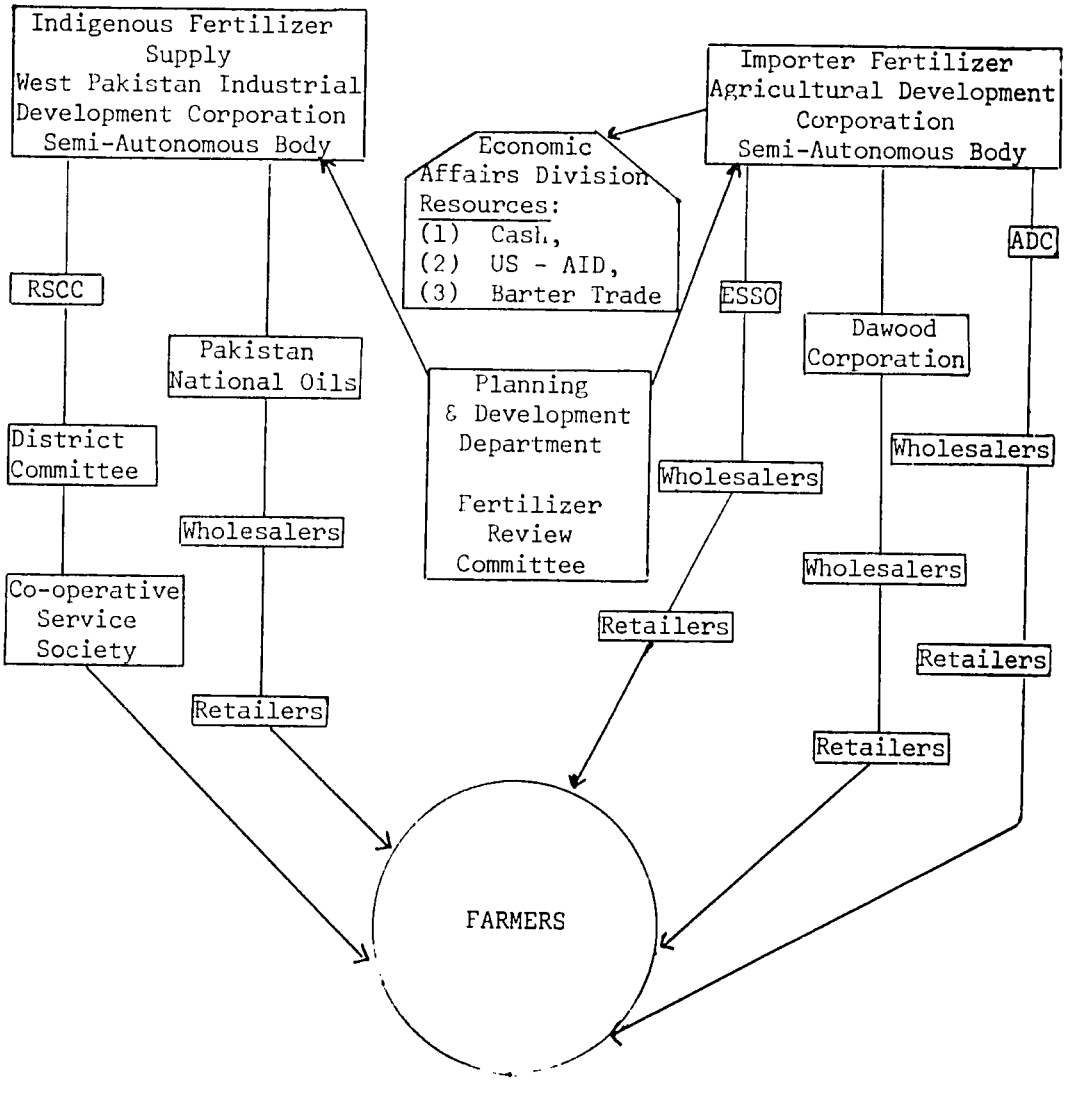
5. *Gian S. Salota, Fertilizer in Economic Development: An Econometric Analysis. (New York: Fredrick A. Praeger, Publishers, 1968) pp. 165-88.*

6. *Haldore Hanson, West Pakistan Agricultural Growth; Miscellaneous Report No. 22. (East Lansing, Michigan: Michigan State University, 1967) pp. 23-27.*

7. *Ibid.*

FIGURE I:

THE OLD
FERTILIZER DISTRIBUTION CHANNEL FOR OWNERSHIP AND
CONTROL IN WEST PAKISTAN



than maximizing behaviour of market participants and the shifting priorities of distributors with regard to fertilizer quota allocation, in case only limited supplies of fertilizer were available. Despite the fact that fertilizer market channels were composed of a heterogenous group of distribution agencies, it did not depict the behaviour of an aggregate channel composed of a number of unit channels. The government has traditionally decided on inter-agency distributive shares, installed new institutions, made new policies and determined the patterns of channel configuration on the basis of its own predetermined priorities disregarding the considerations of market competition. Apart from the allocation of resources the government has played the role of regulator of market behaviour and limited the extent of market competition by enforcing a flat pricing system and fixed marketing margins for fertilizer. While vertical flow existed through the market channel, it did not provide for the horizontal flow from one distribution agency to the other in case excesses or deficits of fertilizer occurred among the distribution agencies beyond the annually fixed costs.

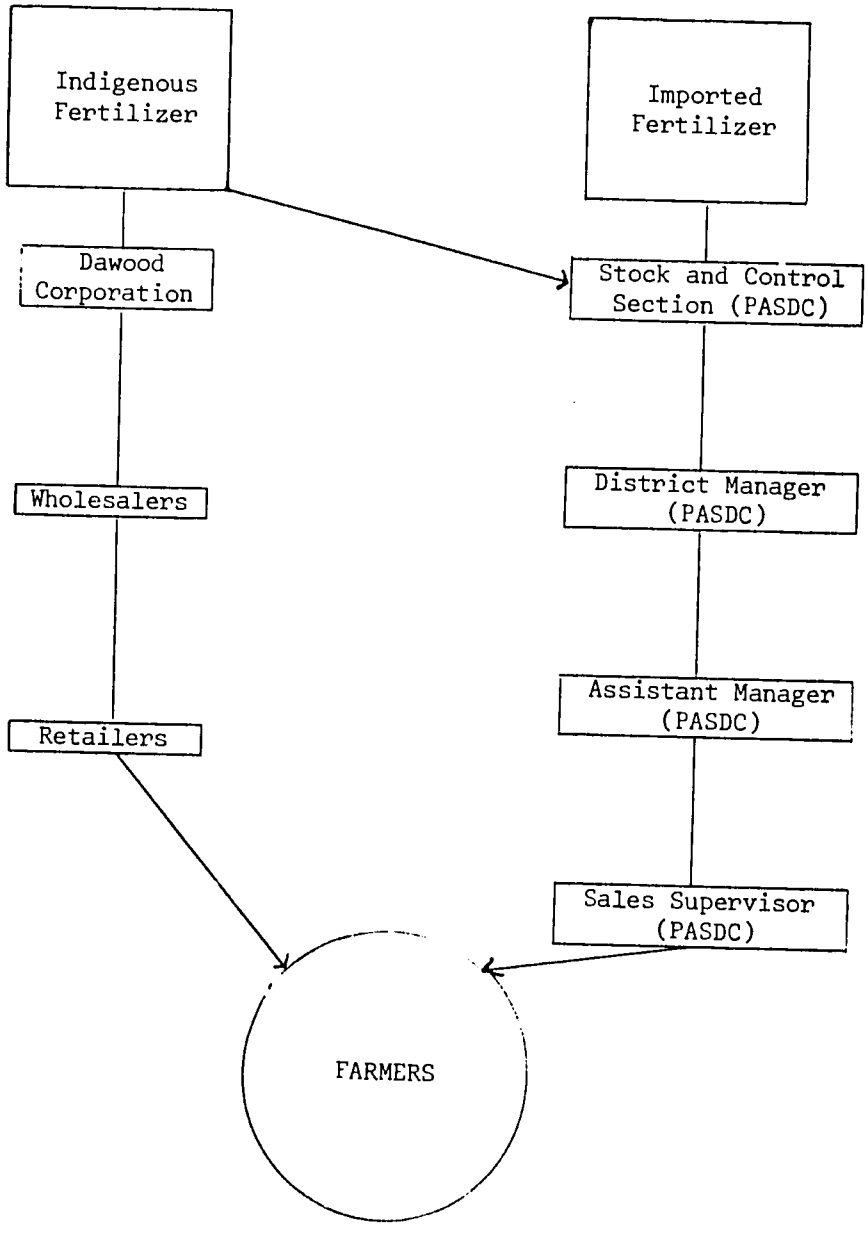
After a long process of evolution, the present system of fertilizer marketing has emerged as a combination of both the public and private distribution agencies. It involves both the central and provincial governments. The former is concerned with the allocation of imported fertilizer among provinces, whereas the latter is responsible for the distribution of indigenous and imported fertilizer among the farmers in respective provinces.

In the Punjab Province, fertilizer distribution is the primary responsibility of the Agricultural Supply Corporation. The Dawood Corporation, a private agency, distributes only a small proportion of the total fertilizer supply in the province which is estimated at 50 per cent of the annual output of the Urea Plant owned by Dawood Hercules. In other provinces like Sind, N.W.F.P., and Baluchistan, the entire fertilizer distribution is almost completely in the hands of respective provincial governments. Since the Central government distributes imported fertilizer among all the provincial governments, it creates some allocative inefficiencies in so far as the imported fertilizers could be distributed in areas lying close to the seaport of Karachi. The Punjab Province can meet its requirements by obtaining fertilizer from Sind or getting a greater proportion of the imported fertilizer. The N.W.F.P. can ship fertilizer from the supply point in Punjab which is close to the N.W.F.P. This would help considerably to reduce the high costs of transporting fertilizer over longer distances. It would also reduce the lead time needed from the point of initial shipment to the point of ultimate consumption and similarly the time required for the replenishment of inventories at distant places.

The Agricultural Supply and Development Corporation (ASC) is a top-

FIGURE 2:

THE NEW ORGANIZATIONAL STRUCTURE OF FERTILIZER DISTRIBUTION IN THE PUNJAB PROVINCE



heavy distribution structure. It has representatives both at district and tehsil levels called Assistant Directors and Assistant Managers respectively. It is further decentralized into retail outlets located at various places in each tehsil being operated by a stores supervisor and one helper. On the other hand, Dawood Corporation, which started as a small distribution agency, is spreading its tentacles into the entire Punjab Province. Both of these agencies must supply fertilizer at the fixed government prices of Rs. 55/- per bag of urea and Rs. 57/- per bag of D.A.P.

A major development in this direction has been the drastic withdrawal of government fertilizer subsidies resulting in a 100 per cent increase in fertilizer prices over the last three years, except for imported fertilizer which must be subsidized so as to bring it to par with the price of indigenous fertilizer. The prices of agricultural commodities have not risen proportionally. The price of wheat increased by 32 per cent, that of rice by 50 per cent and the price increase of sugarcane stayed at 48 per cent during the same period. The prices of cotton increased by 100 per cent, thereby affecting the input resource allocation among the crops at the farm level. The policy change at the government level has resulted not only in a net reduction in fertilizer use on a crop basis by the farmer, but also in slowing down the rate of growth in fertilizer demand. This has, however, been partially offset by the fertilizer promotion policies in the form of provision of supervised credit made available both by the Punjab Agricultural Supply and Development Corporation and by commercial banks.

In view of the relatively poor performance of the private sector in the past due to the recurring emergences of black markets, adulteration and hoarding, it is suggested that the government, as director of economic activity, must completely take over all fertilizer distribution activities from the private sector and function, as a regulated monopoly, in the broader interests of social welfare.

SUPPLY OF FERTILIZER

The two major sources of fertilizer supply in Pakistan are imports and indigenous production. In comparison to the continuous and stable supply of domestic fertilizer, imports are subject to considerable volatility. An important auxiliary variable that influences the magnitude of fertilizer supplies in any particular year is the availability of foreign aid and foreign exchange for imports. Foreign exchange, being the scarcest commodity in Pakistan, is subject to variations in allocation which may lead to fluctuations in the quantity of imported fertilizers that might be available. This might in turn introduce shocks to the dis-

tribution system. Conversely, the seasonal nature of demand affects the behaviour of market participants who have to build up higher inventories to smooth out temporal variations in demand. These variations result in increased credit requirements of distributors for expanding storage facilities and meeting the operational storage costs and may also adversely affect the crop prospects of farmers due to non-availability.

In contrast to the seasonality of demand, the supply of fertilizers is continuous, as it passes through a variety of chemical processes and centralized systems of production. The continuity of supply is, however, maintained through the year round availability of raw material (from indigenous or external sources) and an employable labour pool to the local fertilizer producing plants. Assuming a stable supply position of indigenous produced fertilizer, changes in the overall supply take place because of variations in the magnitude of imports. Whether or not it will arrive in time depends upon the availability of a scarce commodity like foreign exchange and the surplus capacity existing with the exporting firms. The extent of spatial variation in supply depends to a great deal upon the location, size and number of supply points as well as the location of demand points, the intensity of demand and the efficiency of inter-market movement of fertilizer.

Fertilizer imports constitute an important component of the overall supply in Pakistan and variations in this component are likely to result in fluctuations in the market supply. From the temporal standpoint, inaccurate timing of fertilizer imports affects its availability at a particular point in time in a given crop-year. The bottlenecks in fertilizer channels to the farmer, however, lead to spatial variations in supply. Thus, in case of free market operation, prices of fertilizer are likely to vary at a particular time and place unless appropriate measures are taken to stabilize them. In Pakistan, fertilizer has been continuously imported since 1952-53 to supplement the indigenous supply with a view to achieve market penetration and stimulation of demand. Foreign exchange is a scarce commodity in Pakistan's economy which must be allocated among high priority alternatives. If fertilizer imports are to reach the farmer in time, they must be planned about six months ahead of time so that the required foreign exchange allocations can be sought and the tenders given. At present, the only importer of fertilizer in Punjab and other provinces is AS & DC. Whether or not fertilizer imports arrive in time depends upon how early the orders were placed and how well the internal distribution system can handle the relatively large supply of fertilizers by channelling it into given outlets. Empirical evidence shows that in spite of a generally rising trend, the demand for fertilizers from year to year does not show a constant increase but rather irregular fluctuations which may be due to a number of uncontrolled variables. In view of the stable supply of indigenous fertilizer, the irregular changes in consumption must be offset by changing the mag-

nitude of imports or even by doubling the stabilized stock in order to ensure its smooth flow to the farmer and prevent the occurrence of black markets. In cases where aid has to be negotiated and tenders to be invited, fertilizer import requirements must be determined ahead of time. The work must begin in January if the fertilizer is to be shipped from the port of departure by mid-April and unloaded at Karachi in July (this allows a period of 1-1.5 months for the internal transport and distribution system to perform its function), so that it reaches the farmer by mid-August or September. In other words, arrangements for fertilizer imports which must be consumed by the farmer in the month of September must begin in the previous December.

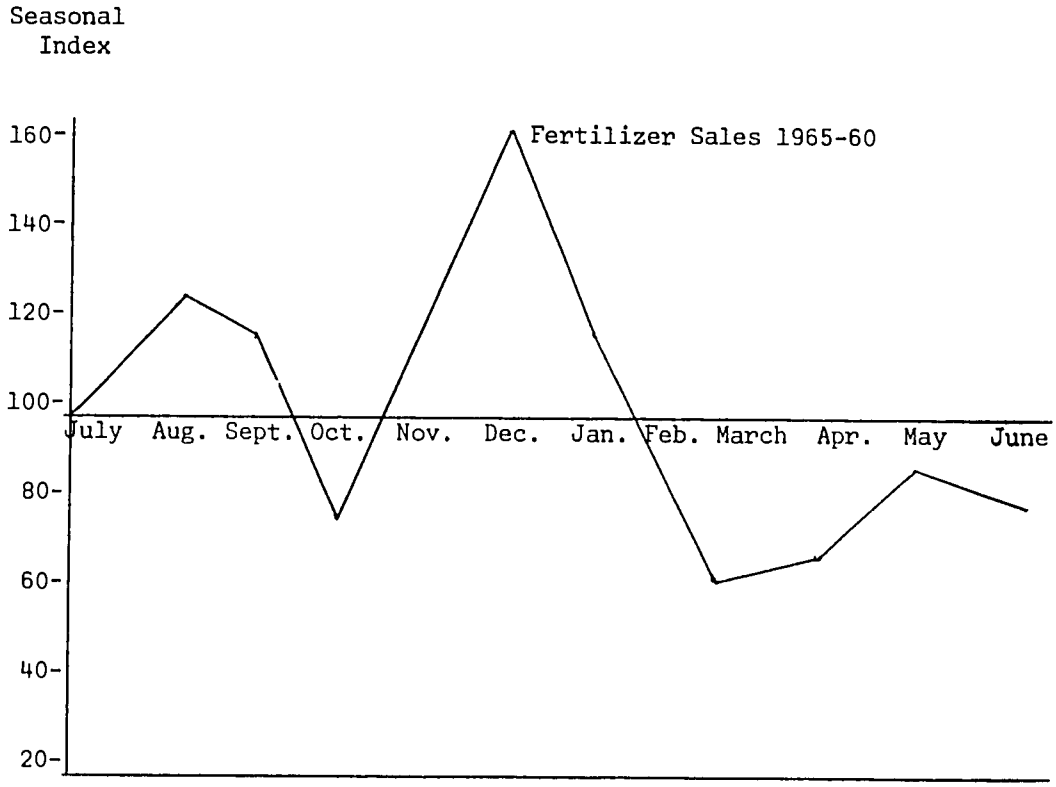
The arrivals of fertilizer loaded ships are not well scheduled. The docks are not busy all the year round - ships may arrive three at a time and then none for 3 months. This results in irregular demands for the limited dock space and for dock workers to unload, bag and store the fertilizer. Even if the bids for fertilizer delivery were given in time and the ships arrived well-scheduled, the unloading, bagging and storage can keep the dock busy 8 months a year. If the work takes more than 8 months there can be fertilizer losses by caking, spoilage, delayed supply to farmers and/or non-availability of limited dock space for alternative uses. In view of the considerable dependence of our economy on fertilizer imports, a large warehouse may be installed at Karachi, assuming the stock turnover ratio remains at least at 15-20 per cent. This could regulate the movement of incoming and outgoing shipments in view of the limited railway handling capacity. (Appendix II)

THE DEMAND FOR FERTILIZER

The demand for fertilizer in Pakistan is highly seasonal and tends to vary with the sowing times of the two major crops: Rabi and Kharif. An index line of seasonal variations for fertilizer sales (based on a 12 month moving average of monthly sales data for Pakistan) which indicates the demand for fertilizer, is marked by peaks and troughs (Figure No.3). Fertilizer demand reaches its peak in December when the major stable food crop of wheat is grown during the Rabi season. Fertilizer sales are second highest during the month of August when it is used for top dressing of cash crops like sugarcane, cotton, fruits and vegetables. Fertilizer demand reaches its lowest points during the months of October and March which do not coincide with the timings of fertilizer application. Temporal variations in fertilizer demand do, however, interact with spatial variations. The intensity of fertilizer demand has the tendency to vary with the degree of availability of complementary inputs like irrigation water, improved seeds, type of soil, pesticides, agricultural credit and systems of land tenure. Agronomically, the use of

FIGURE 3:

INDEX OF SEASONAL VARIATION



Source: Computations are based on the data issued by the Planning and Development Department; Government of West Pakistan, Lahore.

fertilizer and irrigation water is complementary in crop production. Fertilizer consumption is likely to be high in areas with a regular and dependable source of water supply which permits efficient water management and yields reliable but substantial returns for fertilizer use. The degree of fertilizer use is considerably low in areas which depend on rainfall to feed an irregular and low volume of water supply with a considerable degree of variation and uncertainty in the farmers' investment returns.

As a commodity of indirect consumption, fertilizer use requires technical knowledge and a time lag before the desired crop output can be obtained. Unlike suppliers, the users of fertilizer are essentially a multitude of decision-makers in agriculture who are widely scattered geographically. They vary not only in economic status and potential, but also exhibit a widely varying pattern of attitudes and motivations that are subject to a considerable variety of institutional connections.

SOME PROBLEMS OF FERTILIZER USE AND DISTRIBUTION

Most farmers are hesitant to use phosphatic and potash fertilizers, because they do not know about their contributions to farm productivity. It may be stated that the experimental N/P optimum ratio at the field level is 2:1, whereas the prevailing ratio is far less than the optimum.

Table: Nitrogeneous and Phosphatic Ratios of Fertilizer use in Pakistan

Year	N/P Ratio
1969-70	7.7 : 1
1970-71	8.5 : 1
1971-72	8.8 : 1
1972-73	5.4 : 1 (Target)
Optimum Ratio:	2.1

In general, there is a complaint from the farmers that powdery fertilizer is difficult to broadcast, as it damages the leaves of plants

and should be made available in the crystal form. Second, the farmers lack technical knowledge concerning its methods of application and timing. Third, the present system of fertilizer distribution stops short at the tehsil level or major town centres in the rural areas, which creates difficulties in making fertilizer available at the right time and place, thereby reducing the farmers' accessibility. Fourth, the existing system of distribution does not take into account the local and prospective demands of the retail outlets at various geographically scattered sale points, but runs on the basis of a pre-designed policy of distribution. It implies that shortages and surpluses can take place in various rural consuming areas, resulting in the deprivation of certain potential advantages to the farmers. The present system, however, does not provide for its supply at the right time and place.

Fifth, fertilizer availability is greatly impeded by the non-existance of low, medium and high capacity routes through rural Pakistan, which involves considerable time and transportation losses for the farmer. Sixth, the non-availability of such critical inputs as improved seeds, irrigation water, pesticides, fertilizer and agricultural credit in the package form, greatly hinders the increased use of fertilizer. Seventh, the lack of any planning for the matching of supply to overcome the uneveness of demand during various periods of the year leads to the creation of artificial scarcities resulting in black market prices.

PROMOTION OF FERTILIZER USE

One of the flaws in the existing system of fertilizer distribution is the lack of co-ordination between public-supported sales promotions of fertilizer demonstration plots, private sales efforts and the sales made by A.S.C. Thus much of the activity of Agricultural Extension Department loses its significance, because of the non-availability of fertilizer to extension workers in a specific area and because they are, therefore, unable to demonstrate the higher productivity of fertilizer, the proper dosages, and the right combinations of plant nutrients. It is desirable for each individual distribution agency to maintain its own agronomic service unit as an integral part of the selling and service organization since there is a derived demand for soil testing facilities and other pseudo-complementary services like advice on fertilizer application, selection of seeds and use of pesticides. A major expansion in sales volume can be expected by the suggested combined sales effort. Thus, the distribution agencies in operation must maintain an organized and intensively trained team of fertilizer sales personnel who should be able to give knowledgeable advice to farmers. They must be equipped with portable soil sampling kits to enable them to collect soil samples to be sent for analysis to a central soil testing laboratory and mailed back

to the farmers.

Since most of the fertilizers now sold in the market are unstandardized and non-graded, a government regulated and standardized system of uniform fertilizer grades must be introduced to ease the process of consumer selection and producer specification. The system of grading is frequently defined as "a process of segmenting a highly heterogeneous supply of a commodity into smaller more homogenous groupings which are more nearly substituteable for one another than with other units".(8) The two economic effects that may accrue from such a system of grading are:

(i) Reductions in marketing cost and operational inefficiency; and

(ii) improvements in pricing accuracy.

The beneficial effects which may follow from operational efficiency are:

(i) Increasing the extent of buying and selling by description;

(ii) eliminating time and expense associated with arguments regarding quality;

(iii) encouragement of specialization among suppliers by function, type of product handled and type of outlet; and

(iv) reduction of pressure among suppliers for large expenditures on competitive brand advertising.

The improvements in pricing accuracy may be attained through:

(i) The provision of a universal and generally accepted language by which the qualitative differences of nutrients can be interpreted by farmers and trade alike;

(ii) increased accuracy of price information through improved knowledge and increased price competition; and

(iii) an increase or improvement in the efficiency with which desires and preferences of farmers as buyers are transmitted through the marketing system.

A system of market information dissemination will be necessary to improve the process of decision-making by the farmers regarding allocation, mixture and method of fertilizer use. Adequate, accurate and timely information can lead to effective production and marketing decisions.

8. *W.F. William and T.T. Stout, Economics of the Livestock Meat Industry. New York : Macmillan Co., 1969, pp 445-89.*

Even though the overhead cost of providing such services may be high in the short run, the pay-off from the expansion of sales volume may more than offset the costs. At present no such media for the constant flow of information for the farmer and feed back to the producers exists except for the price levels which are fixed. Information concerning detailed specification of fertilizer dosage per acre in various plant nutrient combinations must be provided to the local farmers to facilitate consumer selection and rational choice. Irrational choices of fertilizers can raise social costs due to less rather than more economical sources of plant nutrients. This is indicated by the fact that in the United States such costs amounted to $61 million or 5-10 per cent of the nation's total fertilizer bill in 1949. (9) Similar calculations made by Zvi Griliches put the "cost of imperfect knowledge at $20 million in 1954 and $44.6 million in 1958".(10) In other words, it must be clearly demonstrated to the farmers that two bags of fertilizers with a 50 per-cent nutrient content for each acre is equal to one bag containing a 100 per cent nutrient content in the same combination.

An additional development which would constitute a vital link in the present system of fertilizer distribution is the provision of fertilizer mixing facilities. The need for fertilizer mixtures has assumed greater importance in Pakistan due to the increased realization by farmers regarding the use of balanced doses of fertilizer. The consumption ratio of nitrogenous and phosphatic fertilizers ($N:P_2O_5$) which was 1:6 in 1967-68, decreased to 1:4 in 1970. Fertilizer mixtures are also likely to contain an improved ratio of potash, nitrogen and phosphates, because of the potassium deficiency in some areas of the country. Fertilizer mixing plants must be located near the areas of primary consumption so that the process of sorting the needed fertilizer nutrients in keeping with farmer needs can be facilitated. From the long-run standpoint, it would be desirable to lay emphasis on the supply of centralized fertilizer mixing facilities with considerable adulteration. It is suggested that the government should enact a legislation prohibiting the malpractice of hoarding, dishonesty in dealings and impurity of fertilizer mixtures.

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9. *Jesse W. Markham, The Fertilizer Industry - Study of the Imperfect Market (Nashville, Vanderbilt University Press, 1958).*

10. *J.R. Moore and Richard G. Walsh, Market Structure of Agricultural Industries (Iowa City, Iowa State University Press, 1966).*

SUGGESTIONS FOR IMPROVEMENT

1. The biggest lacuna in the present fertilizer distribution system exists at the grass-root level in the rural areas, where there are no fertilizer purchase co-operatives, co-operative marketing associations or farmer groups which may indulge in group action, make large purchases of fertilizer and assist in making it available to the farmer's door-step. It is, therefore, suggested that either the existing distribution system should be further expanded so as to place retail outlets closer to the farmers or to encourage the formation of co-operatives for the joint purchase of needed inputs like improved seeds, fertilizers, farm machinery and pesticides, etc. Alternatively, the integrated Rural Development Programme (IRD) must be further expanded to encompass all of the rual areas of Pakistan.

2. The anomaly of the present distribution system is that there is no integration between agricultural credit and fertilizer supply which results in the procedural difficulties of obtaining credit and fertilizer from different agencies and the inaccessibility of such sources to small farmers. Also, the Agricultural Supply Corporation in the Punjab Province does not purchase the agricultural produce of the farmers with a view to guarantee a ready market for farmers output. It is, thus, the negation of the old theory of tying-up the credit and input supply.

Dr. A. Rahim Chaudhry is the Executive Director of the Agricultural Development Bank of Pakistan, Islamabad.

A P P E N D I X - I

Availability of Cow Dung per year in Pakistan

Type of Animals	Total Animals in (000)	Tons of Dung Per Year Per Animal	Total Dung Available (000 Tons)	Converted in Nutrient Tons At 0.5% (000 Tons)
Oxen	17,775	10	177,750	88,875
Buffaloes	9,873	10	98,730	49,365
Sheep	12,428	1	12,428	6,214
Goats	9,585	1	9,585	4,792
Others	2,468	5	12,340	6,170
TOTAL	52,129	27	310,833	155,416

Source: Department of Animal Husbandry, Lahore.

A P P E N D I X - I I

Recent and Projected Fertilizer Production, Consumption and Imports in Pakistan

(thousand nutrient tons)

Year	Production	Imports	Consumption
1960-61	11.5	43.1	56.6
1961-62	21.1	38.6	59.7
1962-63	65.4	1.8	67.2
1963-64	79.4	31.6	111.0
1964-65	66.0	78.0	144.0
1965-66	105.1	31.0	136.0
1966-67	106.3	43.7	200.0
1967-68	120.9	254.1	375.0
1968-69	200.3	301.7	502.0
1969-70	347.0	286.0	633.0
1970-71	532.5	227.5	760.0
1971-72	661.0	229.0	890.0

Data from 1960-61 to 1964-65 represent actual production reported by CSO. Data for the year 1965-66 to 1971-72 are projections.

Source: Agriculture Development of Pakistan, by Aziz.

A P P E N D I X - I I I

United States fertilizer prices relative to prices received by farmers for farm products.

Year	Price
1939-40	100
1945	62
1950	50
1955	52
1960	49

Source: Development and Change in Traditional Agriculture: Focus on South Asia. Asian Studies Centre. A miscellaneous paper, 1968.

II. Factors Limiting Fertilizer Use In the CENTO Region

Marketing Distribution of Chemical Fertilizers: Factors Restricting Consumption of Chemical Fertilizers in Iran

Mr. Ali Seyed Ahmedian

Marketing is the processes involved in the flow of goods and services from the producer to the consumer, in a manner that makes the goods and services available to the consumer at the right time and place, and at a price which he is willing to pay. Marketing, therefore, comprises the whole system of operations covering various phases of business activity from the time of production to consumption. It includes management planning, purchasing,sales, price fixing, advertising, transportation, warehousing, etc. It includes all phases of operations relating to the change of location, time and transfer of ownership title of goods and services which would result in their profitable use.

Notwithstanding the discovery of modern techniques in agriculture, there is still an acute shortage of food products in most parts of the world. The relative improvement of health conditions, prevention of infant mortality and infectious diseases have all contributed to a rapid rise in world population. The upheaval of industry has resulted in a rise in the living standards with profound effects on the purchasing power of individuals. In other words, every individual expects to be increasingly benefited by all the gifts of nature including agricultural products. The adoption of new techniques for the preservation and transformation of agricultural products making them available when and where there is a demand for them, the prevention of their spoilage, the creation of new lines of communication and supply systems, transport facilities, etc. are among the factors which have helped the increase of agricultural output to an appreciable extent. At present there is no proportion between the increase in population and the rise in the agricultural output. This condition is more perceptible in developing coun-

tries. In developed countries the use of modern agricultural techniques has contributed to increased yield which is surplus to the requirements of the local inhabitants, but this surplus does not meet the shortage for food products felt in developing countries. To ensure adequate food supplies for the increased population, to check the shortage of food products and prevent hunger, the modern world must resort to extensive measures for raising the level of agricultural crops. The first and foremost of these is the improvement of farming systems in developing countries. Iran is an agricultural country with 56% of its population engaged in the farming of a vast area with varied climatic conditions in mountain slopes, plains, forests, etc. The area favourable for cultivation is so vast that if advanced methods were used for farming, adequate food supplies would be ensured for the physical and mental growth of the people, and the country would have no need to import its food requirements and agricultural raw materials for its industry from abroad.

THE EFFECT OF CHEMICAL FERTILIZERS ON THE DEVELOPMENT OF AGRICULTURE

The agricultural development of each country is directly measured by the consumption of fertilizers. Though fertilizer is not the principal element in farming in the same sense as seeds, water and land, yet it is the main factor in increasing the yield of the crop. According to various experiments conducted by the Soil Institute of Iran, and the reports of the FAO, out of 100,000 tests made in different parts of the world, particularly in developing countries, the amount of profit accrued to the farmer by the use of fertilizer, after deducting the cost of the fertilizer in the lowest crop yields, was equal to the cost of the fertilizer consumed. Several tests made in different parts of the country by the Soil Institute of Iran, have given the following results:

Increased crop prices/price of consumed fertilizer

1.	Wheat	= 2/19
2.	Sadri Rice	= 5/11
3.	Potatoes	= 5/94
4.	Sugar-beets	= 4/78
5.	Cotton	= 2/33

Therefore, the use of fertilizers has resulted in a minimum increase of 20% in production. With the improvement of other factors such as better seeds, proper irrigation and the control of plant pests, the crop yield will be further increased and will be several times the cost of the fertilizer consumed. Fertilizer is the most effective and economic factor in the increase of crop yield, and the country's agricultural growth is proportional to its consumption.

SUPPLY & DISTRIBUTION OF CHEMICAL FERTILIZERS IN IRAN

A. *A Survey of the Country's Needs for Chemical Fertilizers*

Before describing the system of supply and distribution of chemical fertilizers, we have to study the requirements of the country with regard to the type, amount and quality of the fertilizers which could be consumed. According to statistics available, the total area of the country is 164,200,000 hectares and the irrigated area at the end of the Fourth Plan was 3,649,000 hectares. It is estimated that this area would increase to 3,900,000 hectares by the end of the Fifth Plan. Out of this area 3,051,000 hectares would be supplied with chemical fertilizers by the end of the Fifth Plan in 1977. The Plan Organization and State Budget Management will supply the required fertilizers, which have been estimated at 800,000 tons for 1977. For 1973 a total of 420,000 tons has been allocated:

1.	Urea	185,000 tons
2.	Ammonia Phosphate	173,000 "
3.	Ammonia Nitrate	40,000 "
4.	Ammonia Sulphate	15,000 "
5.	Mixed Fertilizers	5,000 "
6.	Potassium Sulphate	2,000 "

If all water farming systems were supplied with fertilizers under an adequate formula, the fertilizer consumption of the country, as already mentioned, would reach 800,000 tons at the end of the Fifth Plan. Improvement of cultivation and application of proper irrigation methods will result in an increased consumption of chemical fertilizers upto 1,000,000 tons. This optimistic estimate is the only acceptable plan which should be implemented by the end of the Fifth Plan at the latest. Thus, if during the first three years of the Fifth Plan there would be an increase of 20% each year, and 15% in the last two years, the consumption figures in all types of farming at the end of the Fifth Plan would be as under:

Year 1351 (1972) - End of Fourth Plan	350,000 tons
Year 1352 (1973) - 20% Increase over previous year	420,000 "
Year 1353 (1974) - " " " " "	500,000 "
Year 1354 (1975) - " " " " "	600,000 "
Year 1355 (1976) - 15% " " " "	700,000 "
Year 1356 (1977) - " " " " "	800,000 "

If this plan is not implemented scrupulously, the rate of annual growth of agriculture will not match the population growth rate which is

about 2.5 - 2.9% per year, and we will have to import part of our food requirements from abroad. Subsequently the low rate of agricultural growth will adversely affect our industrial growth on which it depends.

B *Supply Procedure of Chemical Fertilizers*

In the past all chemical fertilizers required for agriculture were imported and distributed by the private sector. Some years ago the Iranian Government felt the importance of various types of chemical fertilizers in farming. Since the necessary raw materials for production of chemical fertilizers were made available in the country, two plants were set up in Shiraz and Shahpur for the supply of products for internal consumption and possible exports. Presently these two plants only meet local market demands, but provisions have been made for their expansion in order to export in the future. However, in view of the fact that these two plants are unable to supply local market demands for chemical fertilizers, the private sector is importing the balance from abroad. Occasionally certain government departments also import fertilizers, but this is performed under the authority of the Technical Council of Fertilizers and with the agreement of the Ministry of Agriculture.

C *Distribution Network of Chemical Fertilizers in Iran*

The two mentioned plants, Shiraz Chemical Fertilizer (Marvdasht) and Shahpur Chemical Co. Ltd., were set up to supply the chemical fertilizers required by the country. At the outset, some were manufactured locally while some were imported. The rapid expansion of factories resulted in the gradual increase of production, which, in turn, caused a reduction of imported supplies. The distribution of fertilizer in the public sector was formally entrusted to the Chemical Organization affiliated with the Ministry of Agriculture. With the commissioning of two chemical fertilizer plants, a company was formed under the name of Chemical Fertilizers Distribution Co., affiliated with the National Iranian Oil Company, and was charged with the distribution of the product throughout the country. It is planned to make the company a subsidiary of the Ministry of Agriculture. The company distributes chemical fertilizers throughout the country at uniform prices. Sales are made on cash and credit basis. The company has allocated credits for the establishment of strategic depots all over the country to store local and imported fertilizers proportionate to the requirements of each area so that supplies may always be available and within the reach of the farmer on demand. Selected area sales representatives take delivery of the fertil-

izer and distribute it over the area, adding their own sales commission to the cost. In addition to these sales representatives, the Ministry of Agriculture and Natural Resources with the co-operation of Government agencies has plans for the development of agricultural production. The Union of Rural Co-operative Societies, farming and producers co-operatives, public and private sugar mills, tobacco factories, tea cultivators, cultivation and industrial companies which were established recently in areas under the dams, and development organizations (such as Jiraft, Qazvin, Varamin and Garmsar) are among the organizations which distribute fertilizers. These organizations obtain supplies before the cultivation season and store them.

D *Storage of Fertilizers Before Consumption*

As already mentioned, the Chemical Fertilizers Distribution Company has set up strategic depots in provincial towns or centres of Ostans in order to supply the requirements of each area. The company studies and estimates the quantity and type of fertilizer required by the various areas before the cultivation season sets in. It transports and stores the different types of fertilizers for distribution. In addition, sugar factories, farming and producers' co-operatives, rural co-operative unions, etc. all have their own depots.

FACTORS RESTRICTING THE USE OF CHEMICAL FERTILIZERS IN IRAN

Any country engaged in agriculture will have to be active in increasing the yield of agricultural crops. In Iran this development function has been entrusted to the Organization for Extension of Agriculture under the Ministry of Agriculture. The Extension Corpsmen establish model farms, training classes, publish bulletins, exhibit films and arrange exhibitions to demonstrate the benefits derived from chemical fertilizers. Consequently, statistics show that the consumption of fertilizers is on the rise every day. Nevertheless, certain factors have tended to reduce the consumption of chemical fertilizers in Iran. These factors, which are common to all countries, are:

A *Shortage of Water for Irrigation*

An important factor in the consumption of chemical fertilizers is water. Water dissolves the fertilizers in the soil and helps the absorption of its useful elements by the various parts of the plants. Water

for cultivation is supplied from different sources: rainfall, deep and semi-deep wells, irrigation canals from dams, Qanats, rivers, etc. In Iran, with the exception of the Caspian shoreline, the dearth of rainfall is a restricting factor. Ever since olden days a campaign has been underway for the supply of adequate water resources by sinking Qanats (subterranean water channels), rivers, dams, wells, etc. but none of these have been a solution to the chronic problem of water shortage. Once every few years our country has been unable to provide for even one half of its food requirements due to drought and lack of rainfall. In the past few years extensive measures have been taken to supply water for cultivation and complete utilization of water resources. Huge dams have been erected on rivers, and water channels have been set up for the distribution of water. In addition, earth dams have been laid with the help of development funds and the self help of farmers, deep and semi-deep wells have been sunk and the Qanats have been dredged - all of which have increased the water for irrigation.

B *Lack of Knowledge*

Another factor is the lack of accurate knowledge on the part of farmers about the method, quantity and time of consumption as well as advantages underlying the use of chemical fertilizers. Of course, extensive measures have been taken by the Iranian Government in this connection. The Extension Organization of the Ministry of Agriculture is implementing various projects to acquaint farmers with the advantages of chemical fertilizers.

C *Resistance to Change*

Incredulity and the resistance of farmers to the new agricultural projects is another factor limiting the application of chemical fertilizers. In principle, farmers are not very keen in accepting modern agricultural techniques. Even now some farmers have not yet discarded their incredulity; in particular old farmers who farm in the same way their ancestors did and who are not agreeable to any reform. Nowadays young farmers are not following the traditions of their fathers and have a firm belief in the advantages of chemical fertilizers.

D *Financing Handicaps of Farmers in Purchasing Chemical Fertilizers*

At present this is not an acute problem in Iran, for with the im-

plementation of the land reform programme, farmers have acquired ownership of land in recent years and have made every effort to increase the agricultural productivity of their land and hence their high purchasing power for chemical fertilizers. Moreover, they are given every possible subsidy for the increase of their agricultural output. Farmers lacking purchase power are supplied with the chemical fertilizers on credit terms.

E High Cost of Chemical Fertilizers

Since I represent the Rural Co-operative Societies, and these co-operatives play a major role in marketing and distribution of chemical fertilizers, I deem it appropriate to mention the contribution of co-operatives in these operations.

Fundamental to the "White Revolution" (now the Shah/People's Revolution) launched in 1962 by His Imperial Majesty the Shahanshah Aryamehr, was the land reform which enabled farmers to become owners of the land on which they had previously worked in virtual serfdom. In order to provide guidance and assistance to the new landholding farmers, who were experiencing new freedoms and new responsibilities, the government placed emphasis on creating farmer owned co-operatives which would be responsive to the needs of farmers. As a result, during the past decade, there has been an extremely rapid growth in the number of co-operatives in Iran and a commensurately increased membership of farmers.

At present there are 121 rural co-operative unions in various towns and 8,362 rural co-operative societies actively engaged in promoting the interests of their members. According to the relevant statutes, they have to supply the requirements of farmer members including chemical fertilizers.

According to an agreement reached between the Central Organization for Rural Co-operatives and the Chemical Fertilizer Distribution Co., which was endorsed by the Ministry of Co-operatives and Rural Affairs and the Ministry of Agriculture and Natural Resources, the requirements of co-operatives in respect to chemical fertilizers are circulated to rural co-operatives in towns so that requisitions may be submitted to the Chemical Fertilizer Distribution Co. The Union of Rural Co-operatives and Rural Co-operative Organizations may place orders for the rural co-operative societies that need a minimum of 5 tons and whose locations are accessible by road. The requisition should be accompanied by a promissory note covering the cost of the fertilizers ordered and should be submitted to the Accounts Dept. The Chemical Fertilizer Distribution Co. will, on receipt of the requisition, deliver the fertilizer to the society or union within one month at the latest, and have the relevant

loading note signed and sealed by the managing director of the society or union taking delivery of the consignment. This document will then be forwarded to the CORC, which will, in turn, send the relevant promissory note with the maturity date indicated (9 months after delivery of the fertilizer) to the Chemical Fertilizer Distribution Co. The consignment will then be forwarded and delivered to the address indicated on the requisition accompanied by a map of the route. All transport charges to site of the societies or union will be borne by the Chemical Fertilizer Distribution Co., provided the purchaser's address is located along the truck route. In the case of cash transactions the cost of the fertilizer must be paid to the Chemical Fertilizer Distribution Co. in advance or 48 hours after delivery of consignment. In the case of credit transactions (a maximum period of 9 months), a promissory note equivalent to the cost of the fertilizer on credit basis should be issued. The Company will pay a commission of 400 Rials per ton on the fertilizer delivered and will then deduct the same from the cost of the fertilizer delivered. In this manner, the requirements of co-operatives for chemical fertilizers are provided.

The following table shows the figures relevant to the services rendered by the Rural Co-operative Societies and Unions from 1963 to the end of 1972.

Year	Quantity of Chemical Fertilizers Consumed (In Kilogrammes)
1963	5,000,000
1964	7,134,095
1965	7,914,100
1966	15,469,590
1967	11,598,387
1968	14,543,307
1969	37,164,961
1970	59,224,150
1971	145,329,017
1972	167,887,536

Mr. Ali Seyed Ahmedian is from the Central Organization for Rural Co-operatives of Iran.

Limitations of Fertilizer Use in Turkey

Mr. Sezai Bayraktar

Turkey is an agricultural country and her population is increasing rapidly. For this reason it is necessary to increase the agricultural production to meet the food and other agricultural requirements of the increasing population. The only way for realizing this is to increase the yeild per decar. To increase the agricultural yields, the inputs are the main factors, such as fertilizers, seeds, pesticides, irrigation water, machinery and equipment. The most important input is fertilizer.

There has been quite an increase in fertilizer usage since entering the Plan Period, but this increase is not sufficient and there are some factors which are limiting fertilizer usage. These factors can be summarized in 5 groups.

I INADEQUATE PROVISION AND DISTRIBUTION

In some years there was not enough fertilizer because of difficulties in importing raw materials and fertilizers. The aims of consumption could not be reached because the farmers were not able to get and use enough fertilizers.

II INADEQUATE OPERATING CAPITALS AND CREDITS

Most of the agricultural buildings in Turkey do not have enough operating capital and land. The labour force is generally great. For this reason there is much unemployment and under-employment. The operating capital and credit facilities are so limited that production and the farmers' purchasing power are very low. This situation affects fertilizer usage in a negative way. Considering this fact, small holdings should be given priority consideration concerning distribution inputs and credit.

III DIFFERENCES OF ECOLOGICAL CONDITIONS

Turkey has many different ecological regions because of her geographic situation. Tropical crops such as bananas and tea, etc. can be grown, at the same time that cold climate crops are grown.

Determining the application time and doses of fertilizers for each of the crops and the little areas requires long and detailed work. However, the necessary doses and application times of fertilizers for each crop generally have already been determined and suggested to the farmers but these works still need to be more detailed. So, the difference of the ecological conditions affects fertilizer usage in a negative way.

IV LACK OF MODERN TECHNOLOGY IN USING FERTILIZER

a. The farmers who live in the coastal area apply policulture and know the importance of agricultural inputs. They have high incomes.

b. The holdings which are in the central, eastern and south eastern parts of Turkey have limited ecological conditions. For this reason the farmers who live in these areas generally apply monoculture with traditional agricultural techniques.

In the past years, in given credit and spent efforts in fertilizer usage, the government gave priority to the coastal areas. The importance of agricultural inputs, especially the importance of fertilizer usage in increasing yields, is very well understood in these areas. The experiments are headed towards the economic usage of fertilizer.

In Central Anatolia, intensive extension work must go on demonstrating and teaching the technical uses of fertilizer. At the same time, as mentioned above, the farmers of this region should be supported by agricultural credits.

V INADEQUATE IRRIGATION FACILITIES AND RAIN PATTERNS

In Turkey some regions have a yearly precipitation of 2,500 mm (millimetres), some others have 200-300 mm of precipitation. Also the distribution of annual rain generally is not suitable for agriculture in a large part of Turkey. For this reason the efforts have to intensify to increase the irrigational lands.

Mr. Sezai Bayraktar is a Technician in the Plant Nutrition Section, General Directorate of Agricultural Affairs.

Limitations of Fertilizer Use in Pakistan

Mr. Musahib-ud-Din Khan

I. HISTORY OF FERTILIZER USE

In the year 1952 it was difficult for the Agriculture Department to distribute 20,000 free tons of ammonium sulphate in the province of Punjab because the farmers were absolutely unaware of the usefulness of the fertilizers. However, fertilizer use became popular in the country slowly and gradually. The annual consumption of fertilizer is given in Appendix I.

From a consumption of 41,700 nutrient tons, the consumption in the year 1972-73 rose to 436,495 nutrient tons. Most of the requirements of the fertilizers were met through import. The government took necessary steps and five factories for the manufacture of ammonium sulphate, ammonium nitrate, urea and single superphosphate were established. More factories are projected as shown in Appendix II.

As there were difficulties in the popularization of fertilizer in the beginning, the Central Government started a project entitled, "Rapid Soil Fertility Survey and Popularization of the Use of Fertilizer" with the following objectives:

(i) To assess the fertility status of soils in the various provinces;

(ii) to formulate fertilizer recommendations; and

(iii) to popularize the use of the fertilizers.

Dr. J.G. Vermaat, an FAO expert, worked in collaboration with Pakistani scientists for about 10 years. Resulting fertilizer recommendations were formulated on the basis of experiments in the farmers' fields.

The recommendations for all the provinces were worked out. The recommendations for Punjab are given below:

FERTILIZER RECOMMENDATIONS FOR MAJOR CROPS IN PUNJAB

NAME OF CROP/VARIETY	FERTILIZER DOSES Nutrients in lbs/acre			REMARKS
	N	P_2O_5	K_2O	
1. Wheat				
(a) Irrigated Conditions				
Mexipak, Chenab-70, SA-12, Blue Silver.	90-150	60-120	0-60	Response to potash has been observed in rice soils and soils low in potash.
Indigenous	30-60	30-60	-	
(b) Barani Conditions				
Barani-70	30-60	60	-	Depending on the intensity of rainfall.
2. Berseem	30	100	-	N will work as starter dose for deficient soils
3. Raya	60-90	30-60	-	
4. Oats	90	30-60	30	
5. Potatoes	150-200	100-150	100	
6. Gram	0	60	0	
7. Sugar-cane	100-200	50-100	0-100	
8. Cotton	50-75	30-50	0-30	
9. Maize				
(a) Irrigated	90-120	60-90	60-90	
(b) Barani	80	40	-	
10. Rice				
(a) Irri variety	120-150	60-90	0-60	
(b) Basmati	60-90	30-60	-	
11. Bajra	30-60	30	-	

Five soil testing laboratories were established for the analysis of samples throughout the country. These laboratories help in the analysis of the farmers' soils. Other factors which lead to the increase in fertilizer consumption are:

1. *Planning by the Central and Provincial Governments*

The Planning Commission of the Government of Pakistan sets overall production targets for the various crops in the agricultural sector. Keeping these targets in view, the provincial governments frame their own policies through respective Agricultural Policy Committees. There is a Central Fertilizer Co-ordinating Committee headed by the Secretary of the Ministry of Food and Agriculture composed of officials from the Provincial Agriculture, Finance, Industries, Commerce Departments and the then West Pakistan Agricultural Development Corporation. The principal distributing agents of fertilizers are also invited when required. This Committee makes policy decisions and plans the imports in view of the requirements of the provinces and local production.

2. *Subsidy*

As the purchasing power of the farmer did not permit him to purchase the fertilizers at cost, the government subsidized all fertilizers, both imported and indigenous. A subsidy is the difference between a manufacturing/procurement and the end price fixed by the government. A subsidy grant is shared by the Provincial and Central Governments on a 50:50 basis.

3. *Evolution of High-Yielding Fertilizers*

As a result of the research efforts of the Department, high-yielding fertilizers evolved. From 1956 onwards, intensive Wheat Improvement Programmes were carried out with the help of FAO and USDA and by early 1963-64, a number of cross-bred advanced lines of Mexican origin were available. In 1970, Nobel Peace Prize winner, Dr. H.E. Bourlag and Dr. I. Narvaez joined hands with the scientists in Pakistan and as a result the production of wheat jumped from 4.1 million tons in 1963 to 7.3 million tons in 1973. Fertilizer consumption in the year 1962-63 was 41,700 while in the year 1973 it was 4.36 lac nutrient tons. At present we have the following varieties of wheat.

(i) Chenab-70 for early sowing;
(ii) Mexipak-65 for mid-sowing; and
(iii) SA-42 and Blue Silver for late sowing.

In 1972-73 in the Province of Punjab, out of a total area of 107.9 lac acres, 62.4 lac acres were under Mexican wheat varieties (about 58 per cent of the total wheat area). It may be mentioned that in Mexico,

and in some Middle Eastern and African countries, Chenab-70 has topped the list in the international Spring Wheat Yield Trials for the last 2-3 years. The Research Institutes at Tandojam, Sind and Ternab released Nayab and Khushhal varieties of wheat.

We have varieties of rice like Irri-6, which can yield as high as 70 maunds of paddy per acre and under farmers conditions 50 maunds per acre. In the case of maize, high-yielding varieties like Neelum, Akbar, and Agaiti-72 (Synthetic-501) have been released. The Neelum placed first in the international yield trials in Taiwan, India, Korea, Japan, Nepal and Thailand. In fodder crops, "Sada Bahar" has been evolved which gives 4-5 cuttings during summer. Bajra Napier Hybrid is also a heavy yielding fertilizer responsive variety which, however, has not been used extensively due to the method of propagation.

4. *Tubewells*

Due to liberal government policies and subsidies, the number of tubewells increased tremendously during the last decade. A great scope existed in the Province of Punjab and there was a phenomenal increase in the number of tubewells, as shown below:

In the year	1968-69	...	76,246
- " -	1969-70	...	81,819
- " -	1970-71	...	89,119
- " -	1971-72	...	98,786
- " -	1972-73	...	106,917

II LIMITATIONS IN THE USE OF FERTILIZER IN PAKISTAN

1. *Farmers' Knowledge of Fertilizer Use*

As is apparent from the consumption data (Appendix I) that mostly nitrogenous fertilizers are being used by the farmers. The ratio of nitrogenous and phosphorus varies from 7-9:1. The use of potash is practi-negligible. There is, therefore, a dire necessity to expand the education of the farmers by the audio-visual media as well as by practical field demonstrations. The Institute of the Rapid Soil Fertility Survey and Soil Testing does make about 3,000 trials in the country on different crops during Rabi and Kharif, but they are not sufficient. Although they have served a very useful purpose in inducing the use of fertilizer there is a need to educate the farmers to use the right type of fertilizers at the right time.

The following types and varieties of fertilizers are available in

the country:

Local: Urea, Ammonium Sulphate, Calcium Ammonium Nitrate, Single Superphosphate,

Imported: Urea, DAP, Nitro-Phosphate, TSP, Potassium Sulphate, Muriate of Potash, Ammonium Sulphate Nitrate.

Because the requirements of various crops are different and phosphatic fertilizers are used only at the time of sowing, farmers have difficulty understanding the method add time of application. At the time of sowing, urea has to be mixed with TSP or DAP or SSP. Ammonium Sulphate Nitrate and Calcium Ammonium Nitrate have also to be mixed with a phosphatic fertilizer. Nitro-Phosphate is the only fertilizer which could be used at sowing time, but it is not fit for rice. Complex fertilizers are not fit for side-dressing subsequent to sowing.

2. *Inadequate Soil Testing Service*

The Department of Agriculture is making general recommendations of fertilizer doses for various crops in different climatic and ecological conditions. There is a need to work out the relationship between soil tests and field data.

The distribution functions were handed over to the provinces as shown below:

PROVINCE	DATE	DISTRIBUTION SYSTEM
Sind	January, 1973	
Baluchistan	April, 1973	
NWFP	May, 1973	
Punjab	July, 1973	Punjab Agricultural Supplies Corporation

In Punjab from October 5, 1973, the distribution was nationalized except about 50 per cent of the fertilizer produced by Dawood Hercules is to be sold by the Dawood Corporation. Esso Company still sells its own fertilizer produced in its factory at Dheraki.

Distribution to the owners of small farms has been difficult and lacking; it is the private sector in the Mandi towns who receive adequate distributions. The present organization, viz. Punjab Agricultural Development and Supplies Corporation, has established 650 distribution centres and has a close liaison with the Field Assistants of the Agri-

culture Department in 2,263 union councils. There is a large number of co-operative societies with which they are also co-operating. The decentralized storage pattern has been developed by the Corporation in the period of three months to avoid difficulties in movement of fertilizers to various retail outlets during the season and to insure availability to farmers at all times. The sales points/retail outlets have been planned to cover a fairly extensive area so that the farmers could get their requirements within five miles from their farms.

The Corporation has started well and the sales in the months of November and December, 1973, were very satisfactory indeed as compared with the corresponding months in 1972 as shown below:

MONTH	YEAR	SALE (in M/Tons)		COMPARISON	
		N	P	N	P
November	1973-74	37,500	13,400	111%	92%
	1972-73	17,765	7,115		
December	1973-74*	47,000	6,000	101%	192%
	1972-73	23,324	2,048		

* *Estimate*

It is yet too early to pronounce a judgement on the working of this organization.

In the Province of Sind, the Sind Agricultural Supplies Organization has taken over the distribution while in NWFP it is the responsibility of the Agricultural Development Authority. In Baluchistan where the fertilizer consumption is meagre due to low rainfall, the Department of Agriculture is charged with this responsibility.

3. *High Prices of the Fertilizers and Other Inputs*

The price of fertilizers increased tremendously as shown below:

FERTILIZER	1965-66	1971-72	1972-73	1973-74
Ammonium Sulphate	170.00	340.00	340.00	500.00
Ammonium Nitrate	204.80	435.20	435.20	500.00
Urea	500.00	570.00	700.00	1,100.00
DAP	-	560.00	700.00	1,140.00
SSP	150.00	190.00	190.00	300.00
Nitro-Phosphate (23-23)	-	420.00	880.00	1,100.00

(all prices in Rials)

The farmers have resented the increase in price. However, with the great extension education programme and radio broadcasts, the farmers

were explained the reasons for the increase in price due to increase in the international prices.

The prices of diesel engines, tractors, water pumps and electric charges for tubewells have also increased.

Farm labour, pesticides and other inputs also have been considerably increased.

The water rates for various crops have also increased as shown below:

YEAR	SUGAR-CANE	RICE	COTTON	WHEAT	MAIZE
1959-60	20.00	10.00	10.00	5.50	5.50
1965-66	24.00	11.50	12.07	7.20	6.40
1971-72	32.80	16.86	16.88	10.40	8.40

4. *Low Support Price of Crops*

The farmers generally complain that the output prices of their commodities have not increased proportionately. The support price of wheat, for example, for different years is shown below:

YEAR	SUPPORT PRICE
1960-61	Rs. 13.50
1965-66	13.50
1970-71	17.00
1973-74	22.50
1974-75	25.00

The farmer must be assured of adequate prices for his produce or else he will be reluctant to apply the fertilizers and other inputs. For 100 acres of wheat, the farmer has to spend Rs. 16,700 if he applies one bag of DAP and two bags of urea, which are the medium doses recommended by the Department of Agriculture. There will also be expenses on transportation and application of fertilizers.

III RECOMMENDATIONS

1. *Self-Sufficiency in the Production of Fertilizers*

Fortunately Pakistan has a cheap source of production of nitrogenous fertilizers in natural gas and it is imperative for Pakistan to establish as many factories of indigenous fertilizers as possible within the shortest possible time not only to meet growing demand for the ni-

trogenous fertilizers of the country, but also for export.

Pakistan should also try to manufacture phosphatic fertilizer since we have to import rock-phosphate. Discovery of rock-phosphate in the Hazara district should be exploited as early as possible.

Plants for mixing fertilizers in required ratios should be established along with the production of complex fertilizers to suit our conditions.

2. *Fertilizer Act*

There is a dire need for a Fertilizer Act because quite often the fertilizer is not up to the desired quantity as well as quality and the farmers are disappointed after paying the price of the product which they wanted to produce. Malpractices, though not common, have been noted. Some firms brought our fertilizer with sodium and cloride contents not only unsuitable to, but also injurious to our soils and crops.

3. *Need for the Evolution of High-Yielding Varieties With Less Fertillizer Requirements*

In view of the scarcity of fertilizers in the world market and high prices, the developing countries must intensify the research on varieties which are highly efficient and can produce high yields with even less doses, i.e. with a high grain nutrient ratio. One new variety of wheat named Pothowar has low fertilizer requirements and is now on the approved list.

4. *Organic Manures*

The combination of organic and inorganic manures go a long way in the efficient use of fertilizers particularly the phosphate type. Besides the modern organic fertilizers, compost green manures and farmyard manures also provide adequate nutrients to the plants and can replace the artificial fertilizers to a considerable extent. In countries like Pakistan where temperatures go as high as 120°F, the application of organic manures is essential. The method of harvesting removes almost 100 per cent of the top portion of the crop, unlike some of the western countries where only part of the top portions are removed and the rest of the material is allowed to go into the soil.

5. *Credit*

In view of the high prices of fertilizers and the increased consumption, it is beyond the reach of the small farmers and even the so-called big farmers to purchase fertilizer even on subsidized rates. Credit facilities are absolutely essential. The government has always

granted credit and it has been the responsibility of the Agricultural Development Banks to grant loans to the farmers. The Board of Revenue does the same. The Peoples Government, however, has stepped up the credit disbursement this year and has directed the Commercial Banks to extend such facilities. The credit disbursements until December 21, 1973 are given below:

PURPOSE	CO-OP	A.D.B.P.	B.O.R.	COMMERCIAL BANKS	TOTAL
	(thousand rupees)				
Short Term					
Fertilizer	23,793	61,186	13,387	34,102	132,468
Seed	2,665	4,419	5,194	4,049	16,327
Pesticides	-	26	-	183	209
Tractor Hire	-	-	211	124	335
Others	28,030	2,518	-	628	31,176
Sub-Total	54,488	68,149	18,792	39,086	180,515
Medium Term					
Wells/Tubewells	-	-	17,642	693	18,335
Farm Implements threshers	-	-	541	248	789
Bullocks	-	5,305	9,307	1,111	15,703
Tractors	-	-	-	379	370
Sub-Total	-	5,305	27,490	2,431	35,226
TOTAL	54,488	73,454	46,282	41,517	215,741

Out of a total of 21.7 crores of rupees, 13.24 was advanced for fertilizers alone.

6. *Small Fertilizer Plants*

A large number of fertilizer plants have been set up all over the country. The cardinal principle is to reduce the carriage cost to the minimum and to make fertilizer available at the doorsteps of the far-

mers.

The possibilities of liquid ammonia should be investigated. All that is needed is air, water, coal or gas. Ammonia is manufactured in 100 per cent pure form. It can be carried by the farmers - in steel drums by boats, trucks, carts, etc. It is diluted with water into a 20 per cent solution for application.

Liquid ammonia can be employed very profitably as a fertilizer in Pakistan utilizing small factories throughout the agricultural area to reduce transport costs.

Mr. Khan is Director General of Agriculture (Research) at the Punjab Agricultural Research Institute in Lyallpur.

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KEY

(i) *One lac = 100,000 = 100 Thousand*
Ten lac = 1,000,000 = 1 Million
One Crore = 10,000,000= 10 Million

A C K N O W L E D G E M E N T S

I am grateful to Col. Shaukat Ali, General Manager of Federal Directorate of Agricultural Supplies, Lahore and Co. Muhammad Yasin, Director of Planning, Punjab Agricultural Development and Supplies Corporation, Lahore, who were kind enough to discuss various problems relating to supply and distribution of fertilizer and supplied useful data for the preparation of the manuscript.

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APPENDIX I

CONSUMPTION OF FERTILIZER IN PAKISTAN

YEAR	NUTRIENT TONS			TOTAL
	N	P	K	
1962-63	40,800	900	-	41,700
1963-64	88,000	700	-	68,700
1964-65	85,000	2,200	-	87,200
1965-66	69,242	1,245	-	70,437
1966-67	107,779	3,911	144	111,834
1967-68	177,441	12,777	212	190,430
1968-69	203,521	38,642	2,485	244,648
1969-70	260,566	33,801	1,344	295,711
1970-71	263,519	30,462	1,225	295,206
1971-72	343,973	37,231	744	381,948
1972-73	386,385	48,730	1,380	436,495

APPENDIX II

FACTORIES IN OPERATION AND PLANNED

(A) Installed

S. NO.	NAME OF THE PLANT	PRODUCT BEING MANUFACTURED	INSTALLED CAPACITY	NUTRIENT TONS	
				N	P_2O_5
1.	Esso at Dharki	Urea	173,000	79,000	-
2.	Dawood Hercules Sheikhupura	Urea	340,000	150,000	-
3.	Dawood Khail, Mianwali (1957)	Ammonium Sulphate	90,000	19,000.	-
4. (a)	PIDC Factory, Multan (1962-63)	Ammonium Nitrate	103,000	26,780	-
(b)	PIDC Factory, Multan	Urea	59,200	27,232	-
5.	PIDC Lyallpur-Jaranwala	SSP	54,000	-	9,720
		TOTAL	819,200	302,012	9,720

(B) Planned

S. NO.	NAME OF THE PLANT	PRODUCT	NUTRIENT TONS		YEAR IN WHICH PRODUCED
			N	P	
1.	Expansion of natural gas fertilizer factory at Multan	i) Nitro-phosphate ii) Calcium Ammonium Nitrate iii) Urea	218,000	70,000	1975-76
2.	Expansion of Lyallpur-Jaranwala Factory	SSP	-	9,700	End of 1976
3.	Pakistan Fertilizer Co. Karachi	M.A.P.	12,270	58,000	-
4.	Fauji Foundation	Urea	150,000	-	1976-77
5.	Ahmad Dawood Fertilizer Project, Khandkot	Urea	276,000	-	End of 1977
6.	PIDC Factory, Mirpur Methalow	Urea	220,000	-	-

III. The Establishment & Operation of an Effective & Efficient Marketing Organization

The Role of the Private Sector in Fertilizer Distribution in Iran

Mr. Ghulam Hussain Ghandehari

The total land area of Iran is approximately 1.65 million square kilometres of which hilly, non-arable lands and desert stretches occupy 52% (Table 1). Iran's population is 31 million (1972) and the people living in rural areas constitute 58% of the population.

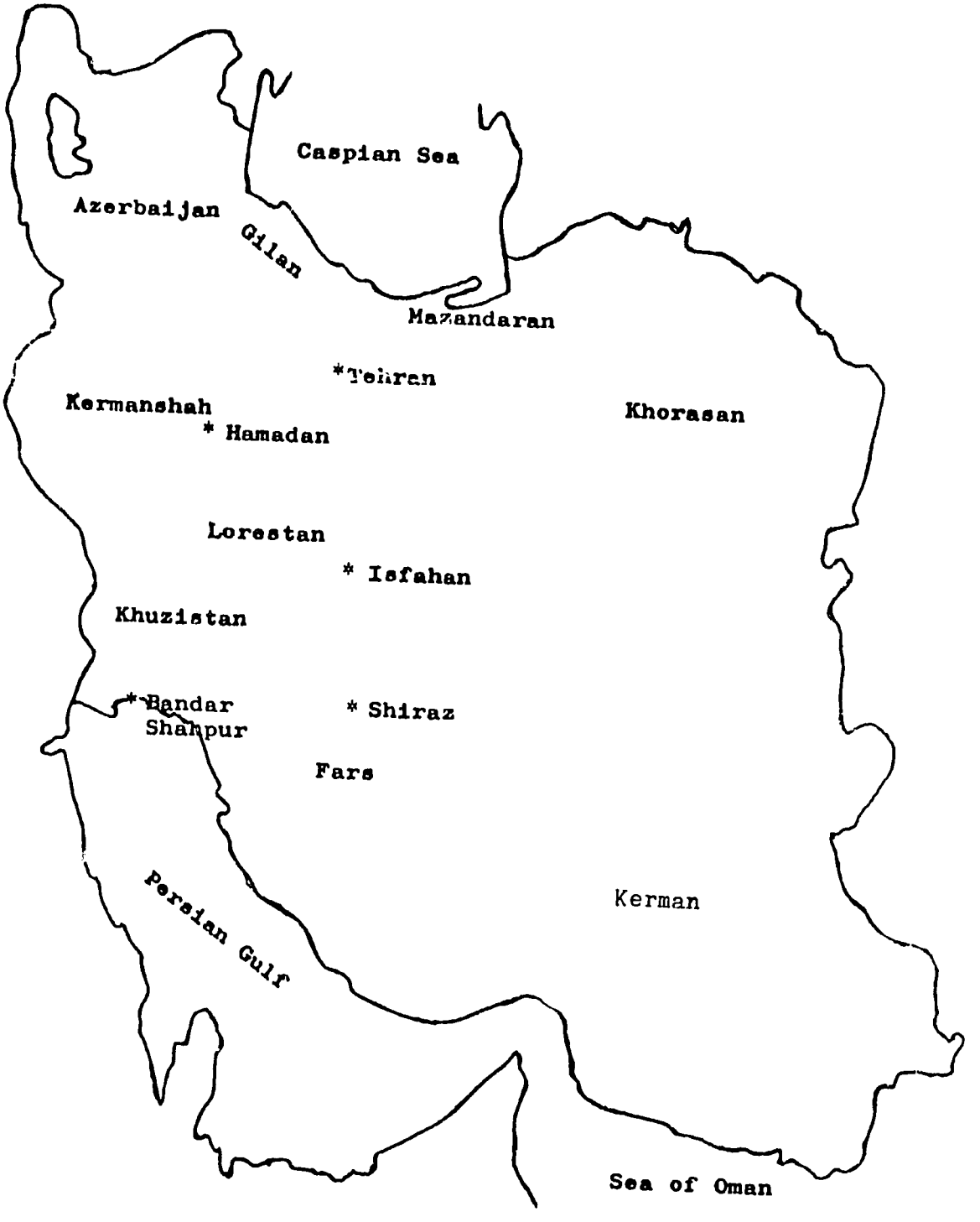
A variety of food and commercial crops are grown in the country. The principal cereals are wheat, barley and rice, while the major cash crops are sugar beets and cotton. Alfalfa and clover are grown as fodder and the major vegetable crops are potatoes and onions. Among the perennial crops grapes, apples, citrus fruits, pistachio nuts and, in the southern regions, dates are important. The areas cultivating the most important irrigated crops are given in Table 1.

Except for the northern regions adjacent to the Caspian Sea, the rest of the country receives a low annual precipitation, and hence, fertilizers are applied on irrigated farmlands.

In 1972, the fertilizer consumption in the country amounted to 359 thousand metric tons equivalent to 172 thousand metric tons of nutrients. (Table 3)

I BRIEF DESCRIPTION OF THE NATIONAL FERTILIZER INDUSTRY.

The fertilizer industry is government-owned. The National Petrochemical Company (NPC) produces fertilizers through subsidiary companies, namely, the Shahpur Chemical Company and the Iran Fertilizer Company, and distributes fertilizers produced through another subsidiary called the fertilizer Distribution Company (FDC).


Caspian Sea
Azerbaijan
Gilan
Mazandaran
*Tehran
Kermanshah
* Hamadan
Khorasan
Lorestan
* Isfahan
Khuzistan
*Bandar Shahpur
* Shiraz
Fars
Kerman
Persian Gulf
Sea of Oman

Map of IRAN

Iran has been a pioneer in the production of chemical fertilizers in the Persian Gulf. The first plant was constructed near Shiraz in 1963. Iran's second fertilizer complex, and one of the world's largest (the Shahpur Complex), is located at the southern part of Mahshar. It began operating in 1971.

II THE STRUCTURE OF THE FERTILIZER MARKETING SYSTEM AND THE ROLE OF THE FDC

The Fertilizer Distribution Company, a government-controlled corporation and a subsidiary of the National Petrochemical Company (NPC), has the main responsibility for the marketing and distribution of chemical fertilizers in the country.

Considerable quantities of fertilizers have been imported into the country by the FDC as well as by the private sector during the last few years; however, beginning in 1972 all imports (amounting to less than 17 per cent of the total consumption) are to be handled by the FDC in order to ensure a better and more organized distribution of fertilizers. The prices of fertilizers are uniformly fixed throughout the country (Table 2).

Considering seasonal demand versus continuous production at the manufacturing centres, sufficient intermediate storage capacity is of vital importance to the FDC's distribution scheme.

Warehousing capacity owned and operated by the FDC in different regions of the country will total 155,000 metric tons by the end of 1974, consisting of 15 warehouses with capacities from 5,000 to 22,000 metric tons each. The FDC's licensed dealers are also required to have a minimum owned or rented capacity of 1,500 to 2,000 tons at their disposal. Rural co-operatives and farm corporations usually have some storage capacity at the village level.

As delivered prices of fertilizers to farmers and consumers are fixed and uniform throughout the country, the FDC takes the responsibility for the pooling of the transport costs. Since the major fertilizer consuming areas are in the north and the manufacturing centres are in the south, the situation results in an average transportation distance of 1,200 kilometres, and hence, considerable costs are involved.

III FDC'S MAIN DISTRIBUTION CHANNELS

A The Role of Government Development Agencies in Increasing the Consumption of Fertilizers

Beginning in 1968, the government undertook special programmes to increase the yield of agricultural crops by supplying improved seeds and chemical fertilizers. The first project was carried out on rice which was followed by projects on cotton, wheat, barley, and forage crops. There are plans to include sugar beets, potatoes and onions under these yield increase programmes beginning in 1974.

Government agencies responsible for implementing the programmes make contracts with farmers providing them with improved seed and fertilizer (in kind) and cash credit. Fertilizer and seeds are both provided interest-free for a 10 month period. Farmers who made contracts with the agencies are required to pay back their loans to the Agricultural Bank within the permitted period. Repayment performance has been quite satisfactory. Since yield increase projects began in 1968, considerable percentages of annual total fertilizer consumption have been marketed through government development agencies.

B Rural Co-operatives

The rural co-operatives' agroindustry and farm corporations purchase fertilizer from the FDC by cash or credit. They are given a discount of Rls. 400 per metric ton of product on the listed price.

C Licensed Dealers

The number of FDC's licensed dealers was 81 in 1972. (1) Licensed dealers are to provide the FDC with real estate mortgages as security against which they obtain fertilizer for sale.

1 Licensed dealers also have secondary sales agents in the villages.

The volume of fertilizer obtained may range from one to three times the value of the real estate mortgaged, depending on dealer's past performance and records.

Licensed dealers are to conform with the FDC's sales regulations of uniform pricing and when fertilizers are sold to farmers, whether in cash or credit, the dealer transmits the sum to the FDC and receives a sales commission of Rls. 400 per metric ton of the product sold.

The licensed dealers must own or have at their disposal sufficient storage capacity to ensure smooth delivery of fertilizer to farmers in their area. The size of storage required may vary from 1,500 to 2,000 tons depending on the area's demand. Dealers should provide farmers with technical advice and printed material on fertilizer use which are supplied by the FDC's technical advisory service. They are called upon to attend semi-technical seminars arranged by the FDC.

D *Sales Agents*

The number of FDC's sales agents increased from 161 in 1971 to 172 in 1972. These agents purchase fertilizers from FDC in cash (or on credit if they are able to provide the FDC with land mortgage as security). Agents are given a discount of Rls. 300 per metric ton of the product on the listed price.

E *Sugar Factories*

Sugar factories and all other related government organizations purchasing fertilizers from the FDC receive a discount of Rls. 400 per metric ton of the purchased product.

F *Direct Sales to the Farmers*

Farmers purchase fertilizers from the FDC only in cash and they are not given any discount. Direct sales to the farmers are indeed negligible.

Figure (1) shows the main distribution channels of the FDC, which

handles sales to:

1. Government Development Agencies
2. Rural Co-operatives
3. Licensed Dealers
4. Sales Agents
5. Sugar Factories
6. Farmers (Direct Sales)

Mr. Ghandehari is from the Distributing Company for Chemical Fertilizer.

FIGURE I

MARKETING CHANNEL FOR DOMESTICALLY PRODUCED AND IMPORTED FERTILIZERS (1971)

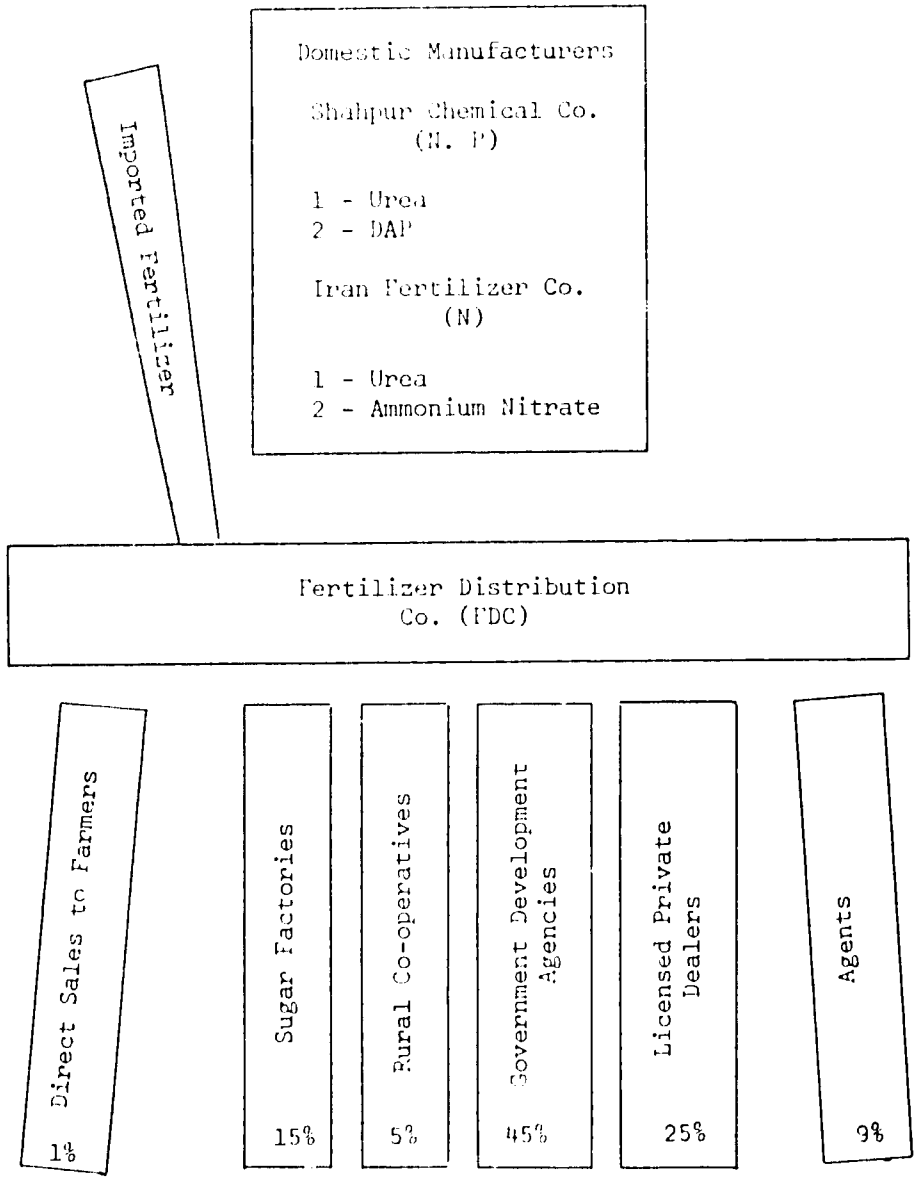


TABLE I

LAND USAGE AND AREA UNDER CULTIVATION (1972)

LAND		AREA IN 1,000 HECTARES	
I	Area under cultivation	7,650	
A.	Irrigated	3,550	
	Wheat		(1,420)
	Rice		(380)
	Barley		(330)
	Cotton		(220)
	Sugar-beets		(150)
	Others		(1,050)
B.	Dry land	4,100	
II	Land under fallow	11,350	
III	Permanent pastures	10,000	
IV	Forest	19,000	
V	Poor but reclaimable soil	31,000	
VI	Non-arable land & deserts	86,000	
	TOTAL	165,000	

TABLE 2

LIST PRICE OF CHEMICAL FERTILIZERS IN IRAN (EFFECTIVE AS OF FEBRUARY 1, 1973)

Type of Fertilizer	Price: Rials/Metric Ton	
	Cash	9-month Credit
Urea (46% N)	8,630	9,350
Diammonium Phosphate (18-46)	10,360	11,200
Compound (15-15-10)	10,200	11,000
Calcium Ammonium Nitrate (26% N)	5,200	5,640
Ammonium Sulphate (21% N)	5,[illegible]0	5,700
Potassium Sulphate(50% K_2O)	8,500	9,200

TABLE 3

FERTILIZER CONSUMPTION BY REGION 1972
(METRIC TONS OF PRODUCT)

Fertilizer Region	Urea 46% N	Ammonium Nitrate 26% N	Triple Superphosphate P_2O_5	Diammonium Phosphate 18-46	Potassium Sulphate 50% K_2O	Ammonium Sulphate 21% N	Compound 15-15-10	Total Consumption
Azerbaijan	13,709	3,388	1,874	4,603	8	29	181	23,789
Gilan	20,603	1,634	19,863	3,843	55	9,058	45	55,101
Mazandaran	37,560	295	14,362	25,437	59	1,195	109	79,017
Khorasan	24,019	5,450	3,493	18,903	97	21	142	52,125
Central Ostan	17,114	4,461	1,060	7,574	153	732	741	31,808
Kermanshah	4,564	66	543	5,003	4	-	6	10,186
Hamadan	3,850	1,490	150	3,001	41	93	27	8,652
Lorestan	2,423	299	206	1,227	1	-	34	4,190
Esfahan	20,254	13,169	76	17,427	8	85	204	51,223
Khuzistan	9,557	308	162	2,928	3	314	300	13,572
Fars	10,330	1,085	277	4,757	6	2	23	16,480
Kerman	7,013	1,348	411	4,063	42	199	103	13,179
Iran	170,996	32,993	42,474	98,739	477	11,728	1,915	359,322

The Role of the Private Sector in Marketing Fertilizers in Pakistan

Mr. Khawaja Amanulla

This Seminar was originally scheduled to be held in November 1973. The Central Ministry of Agriculture invited me to read a paper on "The Role of Private Sector in Fertilizer Marketing" in late September. It was a point in time when the marketing activities of the private sector had been drastically curtailed as a result of discussions made by the Government of Sind and Punjab.

In June, 1973, the Government of Sind decided to allocate all imported fertilizer for distribution to the Sind Agricultural Supplies Organization. They set up depots and retail outlets but also retained a portion of the agency network organized by the private companies. Besides, ESSO was permitted to carry on marketing its production through its own agency network with the stipulation that 86% of its production was to be sold in the province of Sind.

In July, 1973, the Government of Punjab set up the Punjab Agricultural Supplies Corporation. The Corporation initially allocated 60% of the imported fertilizer for distribution through the private sector, retaining 40% for distribution through its own channels. However, in September, a decision was taken to completely eliminate the private sector from marketing fertilizers. As a result, the Corporation not only retained all the imported nitrogenous and phosphatic fertilizers, but also took over the entire share of Punjab from the production of Dawood Hercules Chemicals and WPIDC Plants. The private marketing companies were thus excluded from this business and the entire agency network consisting of several thousand retail outlets was also extinguished. The only exception was ESSO which was permitted to market the Punjab share of their production through their own dealers.

Subsequently, however, 50% of the Punjab share in the production of D.H. Chemicals was released for distribution through private sector channels. In the NWFP, the marketing pattern of fertilizers was left undisturbed. Currently the respective shares of the public and private

sectors in fertilizer marketing in the provinces are approximately:

PROVINCE	SHARE OF MARKET	SHARE OF PUBLIC SECTOR	SHARE OF PRIVATE SECTOR
Sind	22.5%	54.0%	46.0%
Punjab	67.0%	83.0%	17.0%
NWFP	9.0%	23.0%	77.0%
Baluchistan	1.5%	55.0%	45.0%

It may be mentioned that except for NWFP where all types of fertilizer are being marketed by the private sector, the marketing activity of the private sector in other provinces is confined to urea.

It was at the initiative of the Central Government that chemical fertilizers were first introduced to Pakistan in 1952 as a result of an acute food crisis in the country. It was again at the Government's initiative that the manufacture of fertilizers was undertaken in the country.

WPIDC set up its first single superphosphatic plant at Lyallpur in 1957, and followed it up by establishing three more plants: at Daudkhel in January, 1958, for ammonium sulphate; at Multan, in 1962, for ammonium nitrate and urea; and at Jaranwala an additional plant was made for SSP in February, 1968.

The first private sector fertilizer plant was set up at Dharki by ESSO which went into production in December 1968. The second urea plant was established by Dawood Hercules Chemicals at Chichoki Mallian and went into production in November 1971.

The commissioning of these plants made the following production capacity available within the country:

INDIGENOUS PRODUCTION

(FIG. A/W/TONS)

PLANT	ANNUAL CAPACITY	TYPE OF FERTILIZER PRODUCED
D.H.	340,000	Urea (Prilled)
ESSO	174,000	" "
Daudkhel	100,000	Ammonium Sulphate
Multan	99,500	Ammonium Nitrate
Multan	75,500	Urea (Crystalline)
Lyallpur & Jaranwala	50,000	Single Superphosphate

While these plants were being established the Government continued to import fertilizers and promote its use by the farmers. Authentic records of imports between 1952 and 1960 are not available. However, from 1960/61 to 1972/73 the following imports were made:

FISCAL YEAR	NITROGENOUS	PHOSPHATIC	POTASSIC
1960-61	20,699	2,556	-
1961-62	20,759	-	-
1962-63	31,143	-	-
1963-64	5,125	-	-
1964-65	3,204	-	-
1965-66	48,946	-	-
1966-67	106,397	16,391	600
1967-68	103,231	49,316	-
1968-69	117,519	31,979	5,703
1969-70	283,633	6,160	-
1970-71	107,810	38,550	5,000
1971-72	70,440	-	-
1972-73	120,597	70,152	-

Until 1961-62 when the Agricultural Development Corporation came into being, the Department of Agriculture was mainly responsible for the distribution of fertilizer. In 1962-63 the co-operatives were brought in to market fertilizers through an organization known as the Rural Supply Co-operative Corporation. The WPIDC also set up an independent network of mandi town agents for retailing their products. Thus the distribution of fertilizers was in the hands of institutions which were all controlled directly or indirectly by the Government.

Although various means were employed from 1952 to 1967 for marketing fertilizers, the increase in consumption was extremely slow as is borne out by the following figures:

CONSUMPTION OF FERTILIZER IN PAKISTAN

FISCAL YEAR	CONSUMPTION TONS: NITROGEN	FISCAL YEAR	CONSUMPTION TONS: NITROGEN
1952-53	1,050	1960-61	31,290
1953-54	15,120	1961-62	37,590
1954-55	14,490	1962-63	41,160
1955-56	6,720	1963-64	67,620
1956-57	9,240	1964-65	74,147
1957-58	16,800	1965-66	69,242
1958-59	18,480	1966-67	107,779
1959-60	19,320		

The rate of growth in agricultural production was far from satisfactory. Although agricultural output increased in the first four years of the third plan at an average annual rate of 6 per cent as compared to 3.8 per cent during the second plan and 1.4 per cent during the first plan, little growth was achieved during the first two years of the third plan.

The urgency to check the drain of foreign exchange on the import of food grains required a combination of measures for a rapid upsurge in agricultural output. Primarily these were:

a. Import of improved dwarf varieties of Mexican wheat seeds and Irri rice seeds together with active development of high input response varieties by our own plant breeders.

b. Procurement of increased supplies of nitrogenous and phosphatic fertilizers.

c. Vigorous programmes for promoting the adoption of new varieties of seeds, use of chemical fertilizers and development of awareness of modern agricultural technology among the farmers.

The ambitious targets for expansion in fertilizer consumption called for the harnessing of private sector resources and expertise. Consequently, towards the end of 1967 four companies, namely Pakistan National Oils, the Dawood Corporation, Jaffer Brothers and ESSO fertilizer, were appointed principal agents of the Agricultural Development Corporation and were entrusted with the primary responsibility to evolve and develop effective marketing systems and strategy for the promotion and distribution of chemical fertilizers in the country. At this time ESSO's plant was already under construction while Dawoods, in collaboration with Hercules of U.S.A., was poised for undertaking the installation of their Chichoki Mallian plant.

Over the years the private sector has played a commendable role in building up a comprehensive marketing infrastructure on sound commercial lines. Some of the important contributions in this activity are listed below:

1. Qualified and talented personnel (agricultural graduates were given preference) were recruited and imparted in service training. They were provided with adequate transport facilities for mobility in the field to form an elite sales force.

2. Specialists in agronomy, entomology, soil science and agricultural engineering were employed to form technical teams for backing up the sales force.

3. Promotional campaigns through popular media, printed literature, posters, seminars, farmer meetings and demonstration plots were undertaken to disseminate knowledge of modern agricultural techniques among the farmers so that they could learn to get the maximum value out of every bag of fertilizer. Special emphasis was laid on promoting the use of phosphatic fertilizers.

4. Sales targets were planned on a scientific appraisal of consumption potential of districts, based on statistics of cropped acreage and changing patterns. Analytical assessments of limiting factors were made for determining measures to overcome them.

5. Warehouses were established in important market areas for storing fertilizer in periods of excessive supplies.

6. A vast commercial agency network was developed in strategic urban, mandi towns and rural areas. Dealers were given training with necessary technical backup to competently handle, to store and to sell fertilizers of every description.

7. Financial resources were mobilized at every level of the business to eliminate government financing of the trade.

8. Supplies of indigenous and imported fertilizers from various sources were efficiently co-ordinated to prevent the building up of unwieldy stocks.

9. Dealers were progressively oriented, by various incentives, to maintain inventories during slack periods in order to ensure a smooth and regular flow of supplies to the retail outlets, to avoid double handling and prevent over-burdening of our transport systems during peak periods of demand.

10. Moves were initiated to distribute pesticides and high quality seeds through the fertilizer dealers in order to achieve the 'package deal' concept of inputs available to the farmer. Experimental exercises in soil testing, hiring tractors, crop spraying, land levelling, technical advice on farm management, water management, cropping patterns, etc. were also undertaken with hopeful results.

The success of marketing operations by the private sector is illustrated in the figures of fertilizer sale and consumption from the years

1967-68 to 1972-73:

CONSUMPTION OF FERTILIZER IN WEST PAKISTAN

(FIG: N/TONS)

FISCAL YEAR	N	P	K
1966-67	107,779	3,911	144
1967-68	177,441	12,777	212
1968-69	203,521	38,642	2,485
1969-70	272,566	33,801	1,344
1970-71	251,519	30,462	1,225
1971-72	361,000	38,390	740
1972-73	386,385	48,730	1,380

In 1972-73 the consumption of nitrogenous fertilizer increased by 258% over the base of 1966-67 and in the case of phosphatics, the increase was more than eleven times for the same period. The N:P ratio improved from 28:1 in 1966-67 to 8:1 in 1972-73.

It may be mentioned that the private sector at no time held the monopoly of fertilizer marketing and distribution. Various public sector agencies participated in this activity in varying degrees from time to time. Besides, government planning, procurement of supplies and promotional activities made significant contributions to the private sector's accomplishments.

Although the use of fertilizer has become progressively broad based, the current average of application is still very low - about 20 nutrient lbs. per cultivated acre. In the next six years projected targets of consumption are expected to rise to over 1.2 million tons of nitrogen and 448 thousand nutrient tons of phosphatics and potash.

Measured in minimum product tons, the problems of moving 3.5 million metric tons of fertilizer together with the problems of marketing and distribution pose a staggering challenge. The increasing dependence of imports with steeply rising prices abroad have already made the situation intolerable.

There is an urgent need for attracting foreign and local investment in the establishment of new fertilizer plants. Indeed our ample resources of natural gas hold the hope of ultimately developing our fertilizer

industry into an export-oriented industry. Nevertheless, prospective investors in fertilizer plants in Pakistan would legitimately desire to exercise control over the mode of marketing and distribution of their plants' products.

At any rate the scope of our plans for agricultural development is so enormous that there should always be an important role for the private sector to play in achieving national progress.

It is the declared policy of our government that it believes in the concept of a mixed economy for attaining the goals of economic development. The strategy of planning for the future would therefore place reliance on a flexible and pragmatic approach in allocating roles to the public and private sectors for the production, marketing and distribution of agricultural inputs in the best interests of our country and our people.

Mr. Amanullah is from the Dawood Corporation, Lahore.

Building an Effective Marketing Organization

Mr. Victor L. Sheldon

Getting goods from the producer to the consumer used to be a simple operation. Until the 19th century, the producer and the consumer were the same person, or at least in the same family. This is still true for many agricultural products. Beginning with the manufacturing age, the producer separated from the consumer. Many methods were devised to ensure the flow of goods. We are now able to look back at these methods and to study their evolution in three distinct eras: (1) production, (2) sales, and (3) marketing.

At this point, we must distinguish between selling and marketing. Selling is seeking out potential buyers and securing orders for the product, service, or idea. It involves promotion of the product, the use of personal selling, and advertising. Marketing is the performance of business activities which direct the flow of goods and services from producer to user to satisfy the consumer and accomplish the company's objectives. It involves buying, selling, transporting, storing, grading, financing, risk-taking, and market information.

The marketing concept applies to public and private sectors alike. A partnership between private business and public bodies often enhances marketing efficiency and provides effective control. Experience has shown that performance incentives, competition, and profits provide the drive needed for low cost marketing. When public bodies control and direct development plans and policies concerning the economic, cultural, social, political, and legal environment, a commercial marketing system, public or private, can provide within these influences the capital, managerial skill, and organization needed for economic development. The relationships between the external environment and the marketing mix are illustrated in figure 1. Each environment requires a special tailoring of the marketing strategy. Full knowledge of costs must be borne in mind by all involved.

THE MARKETING CONCEPT

The marketing concept provides a co-ordinated approach to the operations of any organization, public or private.

The system (1) insures that the manager knows what and where his markets are, (2) provides effective customer and product service, (3) puts the right product at the right place at the right price, (4) sells to the greatest possible number of customers through the most efficient sales and distribution channels, and (5) supports the product adequately with advertising and sales promotion.*

Management focuses on end-users. It determines the best mixtures of products, promotion, places, and price for the target customers. It selects the mix only after full consideration of the environment. It must obtain facts concerning the cultural, social, economic, political, and legal environment in which it must operate.

In the case of fertilizer marketing, questions such as the following must be answered:

1. What facts are available on the response of crops to various rates of application of this product? Can other agricultural inputs be marketed simultaneously?

2. Are other plant foods necessary for crop growth?

3. What factors limit agricultural production?

4. What prices do farmers receive for their various crops? What is the cost/benefit ratio between this product and the added income from its use? Does government have a floor price on crops? Does it fix retail prices of fertilizer?

5. Are the press and other media available for use in the marketing mix?

* *Edward S. McKay, "How to Plan and Set Up Your Marketing Programme", A Blueprint for an Effective Marketing Programme (Marketing Series No. 91, New York: American Management Association, Inc., 1954).*

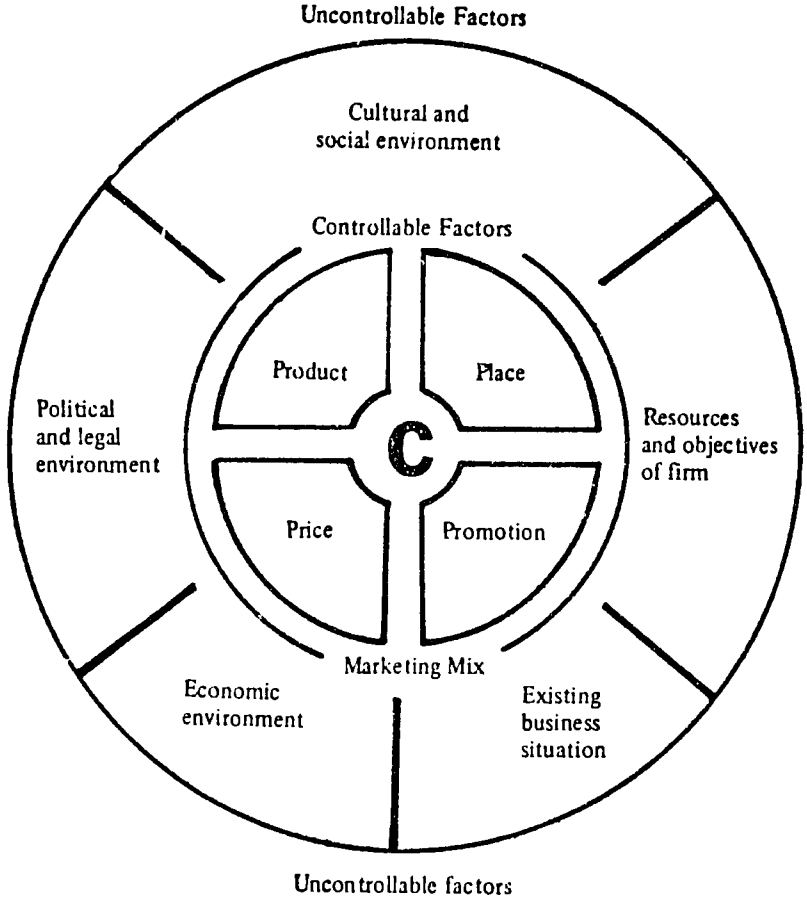


Figure 1. Marketing management focuses on customers, offering marketing mixes (all four P's), within an uncontrollable environment

6. Is the railroad equipment and trackage being replaced or repaired? Roads and vehicular equipment?

7. Is there an adequate storage and distribution system available for the farmers' produce?

8. Is credit available to farmers locally at reasonable rates?

9. What is the ratio of field agricultural extension workers to farmers?

10. In a controlled economy, is an adequate monetary margin allowed in fertilizer pricing to encourage the firm to meet the needs of customers for both goods and services?

I am sure you can think of others. Government regulations control most of these. Answers must be clear before it is possible to establish a marketing organization.

CUSTOMER PROFILE

Just as a general needs military intelligence to establish a battle plan, so must the marketer have information to determine his marketing mix. Knowledge of the needs of the end-user provides the basic foundation of any effective marketing operation. Without it, it is not possible to set realistic sales goals, to determine efficient and necessary manpower requirements, or to develop effective strategy.

He begins by searching libraries for published material on the geographical area. He takes nothing for granted. Facts - not opinions - are needed. He obtains reliable statistical information from a variety of sources: government agricultural departments; private business organizations; financial institutions; colleges and universities; trade organizations. Based on this information, the situation analyst now forms a hypothesis and formulates a questionnaire to obtain missing data to test his hypothesis. The marketer must understand the behaviour of the potential buyer as an individual and how this is influenced by groups of which he is a part. The marketer needs answers to such questions as:

1. Who makes the decisions for buying the fertilizers? (Who does not?)

2. What makes the farmer buy? (Or not buy?)

3. What are their needs? (Physical, psychological, social, or cultural?)

4. Where are the farmers located?

5. Who influences their decisions?

6. How can they be instructed?

7. What type of products do they need?

These appear as simple questions, but the complete answers are often most complex. In planning marketing strategy, detailed facts are needed. The quality and price of the fertilizer, the service offered, and the availability of the fertilizer are forms of marketing input or stimuli. The social influence shown in figure 2 must be known. Written, or pictorial material available on packages or in advertising builds an image about the marketing mix. Social facts include the information which the farmer gets from his family, reference groups, social class, and culture. These inputs attract his attention and appeal to his motives. He then must develop confidence in the product, develop an intention to try it, must buy and receive a benefit - a satisfied need and return for additional purchases. The marketer prepares to adjust his mix to gain maximum value from his investment in each stimuli.

A market is, in simple terms, a summary of individual buyers. With the data collected, you next identify submarkets - large estates, small landowners, tenant farmers, etc., and determine a strategy for each segment.

General data collected on the overall market include:

1. Volume of each fertilizer sold by area within the market.

2. Distribution channels employed. Amounts sold through each channel by month, by crop use.

3. Historical market growth.

4. Market potential by year, by product, by crop.

5. Competitive activity and the company's share of the market.

6. Limiting factors to market development.

7. Packaging needs.

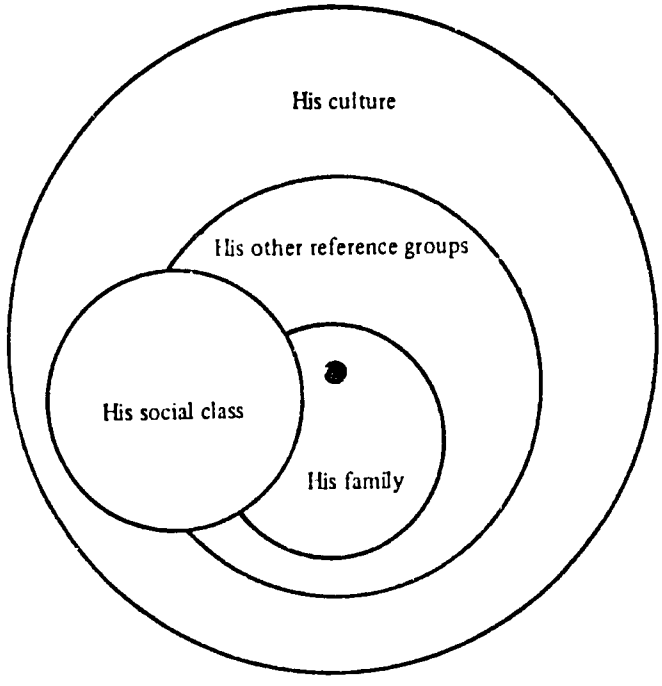


Figure 2. The individual customer decision maker (shown as a dot) is nestled in an environment

8. Communication channels available.

9. Educational needs.

10. Research needs.

INITIATING THE MARKETING PROGRAMME

In organizing their marketing programme, governments should separate their control and policy functions from the marketing organizations. The latter should be established as a separate public or private commercial corporation with motivations for profit and efficiency.

To launch a programme, you separate operations into specific areas of development which function simultaneously. These are: marketing, personnel, administration, and supply (manufacturing).

Over a 30-month period, an entire organization, such as the one shown in figure 3, must be recruited and trained. The positions that are necessary to complete the collection of market information should be filled first. Often, product-use research and dealer-selection surveys must be started early.

Positions of marketing director, sales manager, marketing services manager, and a few key agronomists are filled. As the collection of data nears completion, this team turns to the task of analysis. The distribution manager and the advertising and sales promotion manager positions are filled to aid the interpretation of the data. All these individuals then turn to considerations of the marketing strategy.

Such strategy must fit the life cycle of the product. A fertilizer life cycle can be divided into the four major stages shown in figure 4. The marketing mix changes during each of these stages because customers' attitudes and sales volume change. A substantial share of profits must be retained within the firm for reinvestment in the system. New products, added facilities, and the like, will be needed to enhance efficiency and thus protect the firm against competitive pressure. In the introductory stage, a company needs promotion to pioneer fertilizer acceptance. Potential customers must be told about the product, its proper end-use, and its advantages. This stage is characterized by a large *investment* in promotion, product, place, and personnel development. Such capital is comparable to monies invested in a manufacturing facility. A return can be received only over a period of years. Once a firm has invested in a specific market, it must plan to remain there. It has often been said, "It's more important to own a market than a mill! The mill

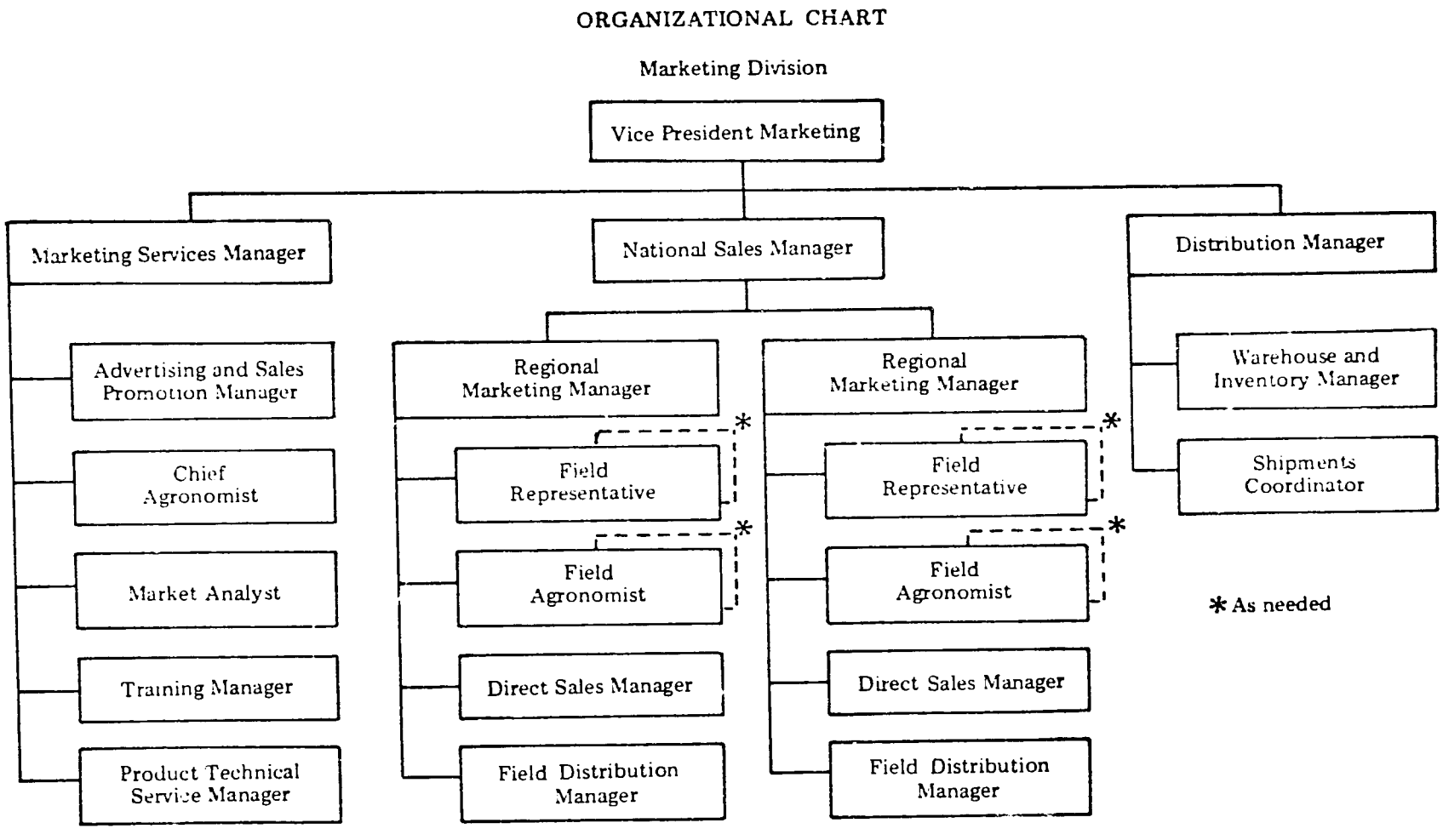


Figure 3. Typical fertilizer marketing organization

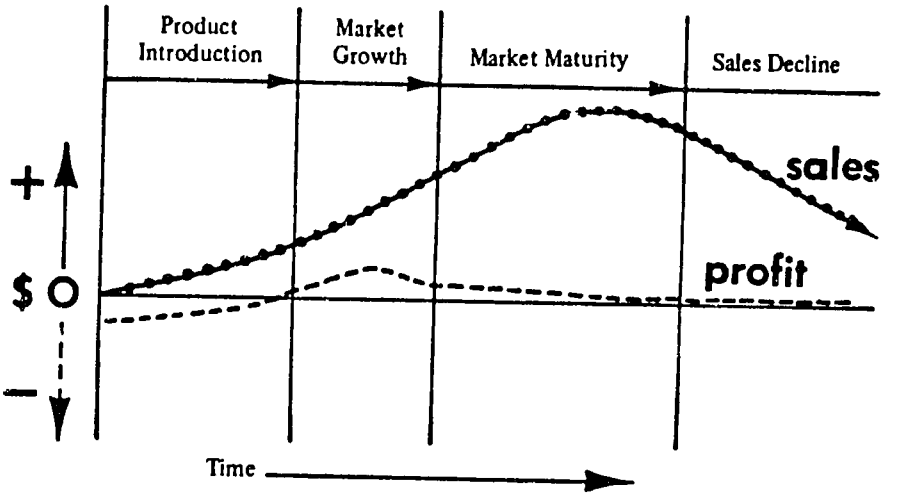


Figure 4. Typical changes in marketing variables during a product life cycle

can burn down and be rebuilt, but an unsatisfied customer will be lost forever".

In the market growth stage, competitors start to enter the market. Sales of the total industry rise rapidly. The market maturity stage may last many years. Competitors force a decline in profits. "Fighting Brands" are introduced. Promotion costs climb and prices are cut, even as the total industry sales volume continues to rise. In the final stage, profits cease. If the firm is to remain profitable, new customer needs must be discovered and products devised to satisfy them. Thus, long-range planning assists short-range decision-making. It helps to determine the marketing mix at time of entry into the marketplace.

THE MARKETING PLAN

Planning is initiated by the marketing director. Based on the information available, the recommendations of his staff, and his own personal experience, he announces his marketing strategy or concept of the operation. Usually he includes:

1. Geographical boundaries of the market.

2. The market segments, i.e., small holders, the estates, etc.

3. The nature and number of retail outlets; i.e., independent dealers or company owned stores.

4. The image of the company he desires to establish.

5. The profit objectives.

6. The marketing organization structure.

7. The financial policy.

8. Target dates for overall marketing operations.

9. The sales volumes.

10. The training objectives.

These decisions guide the preparation of detailed programmes of action which form the marketing plan. It becomes the means of co-ordinating all activities in advance so they can be used to the best effect. It sets out what is to be done (objectives), when, where, and by whom.

It allocates the resources necessary to accomplish the tasks.

With the marketing director's guidance, the following plans are written: sales, agronomic services, advertising and sales promotion, distribution, product technical services, and market information. An outline for each functional plan uses the following as a guide:

1. *Scope of Plan*

   Make a statement of how and why this function ties into the company objectives.

2. *Abstract and Analysis of the Information Base*

   State the information that pertains to this marketing function within the industry and the market. Identify the competition, and the company's internal resources. Where information is incomplete, state and justify assumptions.

3. *Identification of Opportunity Areas*

   State what might be done to expand or change the market. Cite new uses for the product, new products, new technology, and changes in environmental factors.

4. *Objectives*

   Make clear statements of what is to be done by this marketing function in quantitative terms.

   State long-range goals as a marketer, the company image influence, and the provision of services.

5. *Strategy*

   Carefully enunciate the strategy to be employed to reach its specific objectives.

6. *Tactics: Action Schedule*

   Set forth specific and detailed action schedules, time tables, key tasks, responsibilities, personnel, and budget needs.

7. *Appraisal and Control*

   Specify the system for reviewing progress toward achieving the objectives. Set dates of review and the individual responsible for the appraisal, control, and revision.

This act of planning changes the situation in which the company operates. If people are convinced that a certain goal is attainable, they will find ways of attaining it which seem to be worth working on. This is the"self-fulfilling" prophecy. People influence the destiny of their organization by the attitudes and concerns they adopt, and planning is a method of "selling" certain attitudes and concerns. Then, too, the young staff learns to work as a team. A discussion of the technical skills needed to develop these plans is beyond our scope here, but let it suffice to state that blending these skills requires great skill in human resource management.

HUMAN RESOURCES

No marketing system can be better than the poeple who make it function. Several guidelines are worth mentioning:

1. Employ as few as possible to accomplish objectives. A profit motivation helps to keep personnel costs down.

2. Select only the best candidates and pay them well.

3. Keep the company headquarters staff small.

4. Use professional skills. A man who sells to dealers need not be a professional agronomist. A man who works with farmers, must be.

5. Select individuals from the society in which they will work.

6. Give training so that company employees are the best qualified individuals in the market.

7. Provide for decentralization.

8. Fill positions only when they are needed. Eliminate positions when no longer needed.

9. Make every employee a manager (not supervisors).

10. Encourage groups (teams) to meet with managers to plan changes.

11. Identify managerial potential early.

12. Develop career planning to require continuous acquisition of new knowledge and individual growth.

13. Establish job descriptions, limits of authority, goal setting, job enrichment, and pay for performance procedures.

14. Ensure that all have a clear chance to become supervisors. Base selection upon performance.

15. Establish a climate for building trust, team building, group communication, and feedback.

TRAINING

Concurrently, with the development of the various functional marketing plans, additional positions are filled in groups of 20. Each staff specialist teaches the incoming regional managers, agronomists, salesmen, and warehouse supervisors. Use the workshop method to focus attention on group problem solving (guide-discovery). Carefully discuss, and summarize with visual aids. Require an examination. This period of instruction often lasts six weeks. Examples of the subjects covered include:

1. Agriculture of the area.

2. Function of each plant nutrient within the soil and the plant.

3. Production processes used to make the product.

4. Recognition and control of insects and plant diseases.

5. Marketing systems and planning.

6. Role of advertising and sales promotion.

7. How to conduct farmer meetings, field days and the layout demonstrations.

8. Professional salesman's job.

9. How to conduct a market survey.

10. Principles of management.

11. Role of the dealer.

12. Sales administrative procedures.

13. Crop responses to fertilizers.

14. Accounting procedures.

15. Distribution plan and procedures.

16. Territory management.

17. Qualifications of a dealer.

18. Dealer agreement.

19. Transportation plan.

20. Vehicle operation and maintenance.

Supervisors are recalled later for a one-week course entitled "The Practice of Supervision".

In rapidly developing environments, trained personnel are in limited supply. Anticipate very high rates of turnover. Prepare each individual in the young staff for his next career assignment within the firm. Provision of "two-deep" leadership provides the backup needed for suddenly created vacancies.

Upon completion of the basic course, the individuals are assigned their location, issued their equipment, given their job description, and limits of authority. Salesmen initiate the final dealer selection process. The demonstration programme is expanded and possible warehouse sites are surveyed. This first class of trainees begins to function as a team 14 months before any product is shipped to farmers.

ORGANIZING THE DEALER NETWORK

The success of any marketing strategy depends on the quality of the dealers who contact the end-user and manage the retail sales points. They form an integral, yet independent, part of the system. Candidates for any dealerships must be *very carefully screened,* selected, trained, and motivated to perform their key role. The standards for this crucial selection should be based on the following:

1. Ability to sell.

2. Credit rating.

3. Storage capacity - 20 per cent of annual sales.

4. Purchase of farmer's product.

5. Sales of other products to him.

6. Ability to make farm visits.

7. Attendance at training meetings.

8. Participation in field days, farmer meetings, advertising programmes, and forecasting.

9. Place of business and its identification as a company outlet.

10. Respect in community.

11. Knowledge of agriculture.

12. Location within market.

13. Potential of his market.

Specific data on each candidate, along with his sales forecast by month for the next year, are forwarded to the regional manager. He approves the best prospects and returns formal agreements to the dealers for final signature. The first action by the dealer and his company support personnel is to conduct a detailed survey of his marketing area. The next action is to forward the initial order to the regional office.

The location and total number of dealers selected to serve a market area is a critical decision for the sales manager. An optimum size of each outlet at maturity should approach 300 tons of fertilizer. Because each dealer should be contacted by a field sales representative at least once each month, each salesman can manage about 30 dealers. The expense of selecting many very small outlets is prohibitive. A question often asked is, how large an area should a dealer serve? The answer depends on the seasonality of the dealer's total business, the intensity of farming, the crop's grown, the farm size, his other products, and his transport and the profit margin. Certainly, a 10-kilometre radius from sales point is large. If a dealer wants a larger area, another sales point should be established with an employee of the dealer serving as a manager. Each environment will require its own specific determination of criteria for dealer selection.

AGRONOMIC SERVICES

Additional groups of new employees are trained and given positions. All prepare for the first dealer training course and seasonal sales campaign, which are held in conjunction.

A marketing strategy for fertilizers in many environments requires much face-to-face contact with the end-user. A "grass-roots" educational effort replaces much of the mass media in communicating ideas to the farmers.

Agronomic services such as demonstrations, field days, farmer meetings, farm visits, and soil testing form the vital tools of any fertilizer marketing scheme. The agronomic staff assists in the conduct of dealer training and provides invaluable ideas and information for advertising and sales promotion. To ensure that the customer's need is satisfied and that he obtains maximum benefit from the product, highly trained agronomists must be stationed throughout the marketing area. These men must be competent to advise farmers on *all* aspects of agricultural production. They must know cultural practices, seeds, pest and disease control, and practices that may limit fertilizer response. Their efforts "presell" farmers on proper practices and thereby create new demand for all agricultural inputs. They ensure repeat orders for their company products. Frequently, they conduct field research on the crop response to new products. Such powerful professional support provides a sound basis for the establishment and maintenance of a favourable company image. Because of the extreme value of these men, their personal objectives and time allocation must be carefully enunciated in the agronomic service and research portions of the marketing plan. For startup and continued growth in environments with limited other media, an investment in an agronomist for each two sales territories (60 dealers) pays big dividends.

ADVERTISING AND SALES PROMOTION

Because the bulk of communications are on a personal basis in all but the most sophisticated environments, advertising and sales promotion concentrates on those media designed to assist this effort. The use of mass media in stating the selling proposition for a producer's goods, such as fertilizers, should be used to its full value. When appropriately tailored, it often devotes much of its attention to educating the consumer on the product and what it can do for him. Advertising plans call for the early preparation of materials for the first dealer-training meeting (sales campaign). These usually are conducted in the field

for about 100 dealers each, 90 days in advance of the planting of a specific crop. Promotional materials consist of:

1. A product brochure explaining general product use and advantages,

2. a production programme for the crop including use of the product,

3. one-page three-colour "fliers" featuring drawings illustrating the agronomic needs of the crop,

4. colour slides for presentations at the meetings,

5. radio spots, if the media is available,

6. point-of-purchase dealer identification,

7. large posters featuring the advantages of the product for the crop,

8. buntings for dealer use in announcing the availability of the crop production programme and product,

9. farmer-meeting invitation cards,

10. product samples,

11. promotional specialities, and

12. co-operative advertising for use in available print media.

A close working relationship must exist between the chief agronomist, the copywriters, and the artists in the creation of the sales promotion items. A small "internal" production group should be established in the Advertising and Sales Promotion Department.

Press releases announcing dealer appointments, research results, and company activities are sent to radio and newspapers.

Frequently the advertising staff assists in the gathering of market information, package design, trade fairs, speech preparation, and other company image-building activities.

DISTRIBUTION

Distribution is the third largest cost of operating a fertilizer

business, after labour and materials. Detailed planning is necessary to assure that the farmer-customer can have all he needs when he needs it. Special sales campaigns well in advance of the using period help dealers to obtain early orders and allow them to adjust local supplies to meet these needs. Parent companies should transport and store products only in those portions of the distribution channel where they can do it more efficiently than their dealers.

The starting point for the determination of a transportation policy begins with a map of the marketing area. It considers the dealer locations, warehouse locations, and sales forecasts. The distance to each freight zone from the supply point (manufacturing plant) is identified. Transportation equipment needs are determined. Where possible, use of the existing rail network to the maximum extent is usually preferable. The railroad has the capacity of moving large tonnages, and it provides greater security, a method of payment, and is less expensive. Many efficient systems can be devised, but one of the most successful requires the dealer to receive the fertilizer at the railhead in wagon-size lots. If this is over X-distance from his sales point, he is reimbursed for freight. He is not allowed freight if the product is sold outside his sales territory. He is required to have capacity to store at least three wagons (45-50 tons).

Where useful, a rail system requires close liaison with only one agency - the railroad. Shipping can be expedited at the supply point (manufacturing plant) by grouping wagons according to the loading or switching zones in the railroad system. Advice of shipment is dispatched to the dealer through company communication channels. Demurrage at the railhead is at the dealer's expense. He pays in the form of a railroad receipt.

In our discussion of dealer selection, it was mentioned that he should buy the farmer's produce. Frequently, transport used to bring in fertilizer can be used to "backhaul" the farmer's produce to the vicinity of the supply point. This optimizes use of transport facilities. Empties are available when and where they are needed.

Warehousing is particularly important in the distribution of any seasonally consumed product, especially fertilizer. Warehousing adds expense in product shrinkage, handling, personnel, and space costs. The entire distribution flow must be carefully analyzed for all possible alternatives before establishing a warehouse. Perhaps a dealer storage plan can be developed to receive "off-season" production. It is preferable to maximize shipments directly from the supply point to his storage. This gives greater flexibility during peak consuming seasons at less cost than company-managed storage. It promotes greater market cov-

erage that can increase sales significantly. A warehouse should have a through-put of at least three times its capacity to pay for itself in a seven to eight year period. This is difficult in a seasonally used product. Then too, dealers and company personnel become overly dependent on a warehouse and fail to utilize the lower-cost dealer storage facilities.

However, to make efficient use of production facilities they must operate on a continuous basis. Storage, in excess of consumption, must be provided either at the plant, a company warehouse, in transit, or at a dealer warehouse. Usually it is desirable to provide storage for 30 days of production at the plant site if end-user consumption peaks twice a year. Storage for 150 days of production must be supplied "off-site".

Each dealer should provide storage for a volume of product equal to the maximum sales that he ever made in the time that it takes for him to be resupplied. For example, if it takes 14 days for him to receive shipments from the plant, and if the maximum number of tons he ever sold in a 14 day period is 50, his warehouse should always contain 50 tons of fertilizer.

In the total system, dealer storage should be at least 90 days of production. With a 14-day supply time to the average dealer, 14 days of production could be in transit. If consumption peaks every 180 days, the company would need to lease storage for only 46 days of production. In many instances, the size of dealer organization can be adjusted so that "off-site" warehousing will not be needed.

Orders are transmitted in writing from dealers to regional officers and are grouped according to loading zones, and forwarded to the sales manager. He accepts or rejects the orders and passes them to the distribution manager. He issues shipping instructions to the appropriate supply point.

CONTROL

A specific method for reviewing progress toward achieving each marketing objective must be devised. A feedback system to the marketing director is necessary. Sales and cost analysis show only the overall results. By comparing these data, he can make some adjustments, but may be overwhelmed with data. Performance analysis, which shows exceptions or variations, greatly aids their use. A better system involves marketing cost analysis. This requires that all natural cost entries be reclassified into functional cost accounts, i.e., storage, transportation,

selling, advertising, billing, etc. Then these are re-allocated to those items or class of customers for which the cost was incurred. Each function of marketing becomes cost conscious when they plan for their own control. The marketing director can better adjust the overall strategy in future plans.

PHASING OF MARKETING ACTIVITIES

It is useful at this juncture to summarize the marketing events in the sequence they occur in the establishment of a new marketing organization.

Time	*Action*
*M-30**	Market information collected on controllable environmental facts.
M-24	Initiation of product-use field research.
M-20	Personnel applications invited.
	Dealer and consumer surveys initiated.
M-18	Limited number of field demonstrations and field days initiated.
	Marketing plan started.
	Initial sales forecast from marketing survey.
M-16	Training of first group sales and distribution personnel.
M-15	Advertising and sales promotion plan completed.
	Agronomic services and research plan completed.
	Marketing information plan completed.
	Sales plans completed.
M-14	Begin dealer selection.
	Determine package needs.

* *Months before first shipment of products to end-users.*

Training of 2nd group of sales, agronomy and distribution personnel.

M-12 Expand demonstration programme.

Prepare materials for dealer training (1st sales campaign).

Dealer selection continues.

Training of 3rd group of marketing personnel.

M-10 Develop transportation plan.

"Grass-roots" forecast from dealer agreements.

Affirm farmer credit availability.

Develop warehouse plan.

M-8 Begin advertising.

Issue field demonstration signs and kit for farmer meetings.

Finalize order processing system.

M-6 Finalize crop production folders, product samples, banners.

Integrate demonstration results into sales promotion programme.

M-3 Initiate dealer training.

Complete transportation arrangements.

Initiate crop production sales campaign.

Prepare sales point identification materials.

Quality control measures complete.

M-2 Appoint dealers.

Ship stock to dealers, and if necessary, to warehouses.

M-1 Point of purchase materials emplaced.

Farmer meetings.

M Dealer sales to farmers.

CONCLUSION

The establishment of an efficient marketing organization requires a deep understanding as to its complexities and its dynamic role in any economic development. It stimulates both production and consumption. Yet, a marketing system will not spring up automatically. It functions in a cultural, social, political, legal, and economic environment over which it has no control. Public policymakers must share responsibilities for any marketing effort in that they do give control and direction to these environmental factors.

To be efficient, marketing requires a long-range investment of capital in a carefully conceived mixture of human and material resources. Once established in a market, such an organization can very efficiently manage a broad line of similar products. It should be allowed to withdraw from a market only under the pressure of competition.

An efficient marketing system gives added value to products by managing its resources to control the product, its promotion, its location, and its price.

To accomplish these tasks, it makes long lasting inputs into the development of the technical and behavioural skills of all those individuals with whom it comes in contact. Marketing is carried out by people and its efficiency is unavoidably dependent upon their personal capabilities. The development of personnel is the cornerstone of efficient marketing.

In marketing, comprehensive planning integrates behavioural skills with technical competencies. It sets goals for measurement and establishes working teams. Marketing planning is the key to the door to building an efficient marketing organization.

It ain't the guns or armament
Nor tunes the band can play,
But the close co-operation
That makes us win the day.
It ain't the individual
Nor the army as a whole;
But the everlasting teamwork
Of every bloomin' soul.

Rudyard Kipling

Dr. Sheldon is Chairman of the Department of Agriculture, Western Illinois University.

IV. Developing the Market for Fertilizer

The Role of Fertilizer in Agricultural Development in the CENTO Countries

Dr. Darrell A. Russel

The dictionary definition of "development' refers to a gradual advance or growth through progressive change. This is an across-the-board definition. No particular sector is named. From a country or national viewpoint, however, development undoubtedly refers to an improvement in the standard of living of the people. This improvement can be - indeed must be - in many aspects: health, education, relief from drudgery, enlightened leadership, a market for surplus production, a chance to watch television, a whole host of other things. Development is usually subdivided into such broad categories as social, institutional, economic, and the like. Economic development is the most appropriate for consideration here because it is the category in which agriculture usually is placed. Agriculture can also affect social and political development but its chief effect is economic.

Economic development is the growth in output per head of population and the changes in the structure of the economy under discussion (Khan, 1966; Anonymous, 1969). A high priority must be given to agriculture in economic development if for no other reason than that more people are engaged in agriculture than in any other activity. In the developing countries, 75% of the population obtains its livelihood from agriculture and in some countries as many as 90% of the people are dependent upon agriculture.

Agricultural development consists of modernizing traditional production and marketing systems so as to increase productivity. This is the point where so many programmes run into difficulty. Frequently there just are not enough funds for development, including agricultural development, to proceed as fast as it should. Occasionally the importance of agriculture is not recognized in the total development programme and its development is underfunded. Agricultural development *is* important in

the total development programme. Rostow, in his book on *The Stages of Economic Growth*, has stated that "... the rate of increase in output in agriculture may set the limit within which modernization proceeds" (Rostow, 1960).

Agricultural improvement contributes to economic development in several ways. It provides food and fibre for an increasing proportion of the population working outside of agriculture, as shown below:

TABLE 1

U.S. AGRICULTURAL PRODUCTIVITY
(Anonymous, 1971)

Year	Number of Persons Supplied per Farm Worker
1950	15.5
1955	21.7
1960	25.8
1965	37.0
1970	47.1

In 20 years, productivity more than tripled. Most of the drudgery formerly associated with agriculture also has succumbed to mechanization.

Agriculture produces for export and thus earns the foreign exchange needed to import industrial and consumer goods. Agricultural exports have been almost the only source of foreign exchange for many of the developing countries. Table 2 shows that this is the case for the CENTO countries although it applies more to Pakistan and Turkey than to Iran. Oil exports in Iran finance most of the imports into the country. Under normal conditions, agriculture would be the major source of foreign earnings.

TABLE 2 EXPORTS-IMPORTS IN THE CENTO COUNTRIES
(Paxton, 1972)

	Iran 1965/66 million rials	West Pakistan 1968/69 thousand rupees	Turkey 1970 thousand lira
Agricultural exports	6,440	1,156	5,587
Other exports	7,542*	2,098	820
Imports	66,517	4,233	9,598

* *Excludes oil*

Agriculture provides market outlets for consumer goods and services from other segments of the economy. Agriculture also provides raw materials for industries engaged in processing agricultural products. For example, Pakistani exports of items manufactured from cotton were valued at twice the exports of raw cotton in 1968/69 (Paxton, 1972). The surplus earnings from the sale of agricultural products, both within the country and as exports, provide capital for investment in industrial and business enterprises. Agriculture also provides its surplus manpower to other trades and professions.

DEVELOPMENT PROCESS

There are four key statements that apply to agricultural development: (1) agricultural development must accompany or precede industrial development; (2) increases in production must precede increases in consumption; (3) development takes place inside an area, not outside; and (4) use of knowledge is the key to success. Khan has written in *The Role of Agriculture in Economic Development; A Case Study of Pakistan* that, "Most of the contemporary underdeveloped countries have a distinct dual character. In such economies a small market sector, which comprises almost all the industrial activity, ... is superimposed upon a large subsistence sector producing food and other such commodities which are used primarily for self-consumption of the agricultural population. [Assuming that] an industrial sector has to emerge and sustain itself, the agricultural sector must increase its total output right from the beginning ..." (Khan, 1966). The reason for this, Khan explains, is that the new industrial sector will draw upon agriculture for its new labour force. Even though these exagriculturists were not fully employed in agriculture, their leaving creates a void that must be filled by those who remain. These workers must now work harder and longer and consequently will eat more. Those who leave agriculture also will work harder and longer and they, too, will eat more. The net effect is that, for each man who leaves the agricultural labour force, agriculture must increase production on an almost equivalent basis. Any attempt to establish an industrial sector without simultaneously developing the agricultural sector will result in larger and larger shortfalls in food production.

In 1963 Parker estimated that one-half of the world's population suffered from some form of hunger or malnutrition (Parker, 1963). Despite the advances made in agricultural production, about one-half of the world's population still suffers from some form of hunger or malnutrition. There are still many, many countries in which the population is increasing at a rate equal to or greater than agricultural production. Increases in production *must* precede increases in consumption. We have

had this problem in the Valley of the Tennessee River. In fact, this is one of the reasons for establishing the Tennessee Valley Authority. The Valley was a depressed area, made up almost wholly of subsistence agriculture. The soils were poor. Farming methods were poor. Many of them actively promoted erosion. In some areas, erosion had proceeded so far that the land could not be reclaimed for cultivation. Due to erosion and intensive cropping, there was not enough fertility in the soil to support livestock. The people were poor. When TVA was created, the only resources that remained were the people and the worn-out soils. The first step was to make both productive - and so the initial emphasis was on agricultural development. Development started within the area as a co-operative effort among TVA, the land-grant universities, and the people. A lot of one-to-one personal contact was necessary to get farmers started on new paths. Dramatic demonstrations were established and were used for group instruction. Soon, neighbour was vying with neighbour on a whole farm basis to see which could produce the most. Knowledge was the key to success but much of this knowledge had to be developed through research. Ideas were tested in the greenhouse, then with small plots, and finally with large fields. After several years, the changes in agriculture were apparent to even the casual observer. Soon after agriculture was started on the path of development, industrial development was started. The Valley is now a mixture of productive agriculture and productive industry.

FERTILIZER AND AGRICULTURAL DEVELOPMENT

Importance of Fertilizer

Agricultural development does not occur spontaneously. It has to start at a definite place with a definite act. Khan says that the principal question is how to induce 'traditional agriculture' to produce more (Khan, 1966). A statement in some of the literature from the Shahpur Chemical Co. in Iran is significant. "Of all the aspects of the 'New Technology' that affect the creation of a powerful agricultural base, the proper use of chemical fertilizers on soils certainly represents the input that is least expensive to apply, simplest to evaluate and control, most dramatic in effect, and quickest in realization of return" (Allen, Darvish, and Salehy, 1967). This is a familiar statement to those of us who work for the TVA. At an FAO conference in Colombia, Dr. L.B. Nelson, Manager of TVA's National Fertilizer Development Centre, stated: "Traditionally, in the United States, and I suppose in most other developed countries, we look upon fertilizers as a low-cost way to increase output per acre of land and to give the farmer a high economic return for his labour and capital investment" (Nelson, 1968). On another

occasion, Parker and Nelson concluded that plant nutrients were the major limiting factor for agricultural development in the least-developed countries (Parker and Nelson, 1966). They were careful to point out that fertilizer alone would not suffice. For fertilizer to be effective, there must be good seed and adequate water; there must also be protection from insects and disease; and there must be an adequate market.

Agricultural economists have conducted a number of studies to quantitatively relate the contribution of fertilizer to increases in crop yields. This information was recently summarized (Nelson, 1972). In 1965, Heady and his associates at Iowa State University estimated that 45% of the average annual increase in yields for all crops in the United States over the past several decades came from fertilizers. Of the remainder, 6% came from irrigation, 10% from the introduction of hybrid corn, and all the rest from improved seeds, improved cropping practices, and other innovations (Heady, et al, 1965). Ibach (1966) concluded that from the mid-fifties to the early sixties about 36% of the change in crop production per acre could be attributed solely to increased rates of fertilizer application. The U.S. Department of Agriculture studied crop production changes occurring from 1948 to 1963 in 26 developing countries and concluded that fertilizer consumption accounted for one-fifth to two-thirds or more of the increased grain yields (Anonymous, 1965).

HUMAN RESTRICTIONS ON FERTILIZER USE

There are three aspects of the human factor that are important. First, there is a high, positive correlation between the level of a farmer's education and fertilizer use. Reliable information about the level of education is not available in most developing countries but the correlation still holds if the literacy rate for the country as a whole is used. Table 3, based on some rather old data, shows the correlation for several countries. If the correlation were perfect, which it is not, there would be no need to consider any other factors. It appears that a literacy rate of around 50% is needed for fertilizer to be used in substantial quantities.

Secondly, there is a close relationship between the number of extension workers in a country (or rather the number per hectare of arable land) and fertilizer use. Again, certain of the data are old but the principle is sound and useful. The results are given in Table 4. The relationship is inverse as presented. That is, the more land per extension worker, the smaller the quantity of fertilizer used per hectare. An almost identical correlation is obtained for the number of farmers per

TABLE 3

LITERACY AND FERTILIZER USE IN SELECTED COUNTRIES
(Anonymous, 1965 and 1972).

COUNTRY	LITERACY RATE %	FERTILIZER CONSUMPTION kg/capita*
Spain	87	25.6
Costa Rica	79	19.8
Taiwan	54	17.8
Turkey	39	8.2
Pakistan	19	2.9
Iran	15	2.5
Nigeria	11	0.1
Sudan	7	3.4

* *Kg N + P + K/capita total population*

TABLE 4

EXTENSION WORKERS, FARMERS, AND FERTILIZER USE IN SELECTED COUNTRIES
(Anonymous, 1965 and 1972).

COUNTRY	ARABLE LAND PER EXTENSION WORKER 1,000 ha	NUMBER OF FARMERS PER EXTENSION WORKER	FERTILIZER CONSUMPTION kg/capita*
Thailand	34.4	34,555	2.4
Chile	29.3	4,208	8.2
Iran	17.9	5,130	2.5
Venezuela	15.7	2,331	4.4
Turkey	15.0	5,539	8.2
Taiwan	1.0	1,698	17.8
Greece	0.8	403	28.1
Israel	0.6	157	13.7

* *Kg N + P + K/capita total population*

extension worker and fertilizer use (Table 4). It appears that there should be at least one extension worker per 1000 hectares of arable land or about one per 1,500 farmers before fertilizer use begins to expand. Government officials faced with a limited number of extension workers have a limited number of alternatives. At times, the first choice has been to do nothing because the alternative of increasing the size of the extension staff seems impossible. There is a third alternative: private sector extension workers. Usually, these would be called salesmen; when trained to know his job, a salesman can be a major source of information for farmers.

The third aspect of the human factor is research. Growth in man's capacity to produce foods and fibres has increased greatly through improvements in agricultural technology and increases in the capital and skills required to use the technology. Until the 19th century, most technological improvements were either accidental discoveries or products of relatively few individuals. Since the middle of the 19th century, a steadily growing stream of improved agricultural technologies has developed (Anonymous, 1965). Most of this technology has developed in the United States, Europe, and Japan. Some of it is transferrable to tropical zones - such as high analysis fertilizers, agricultural equipment, some new varieties of crops, and the like. There is a need, nevertheless, for a great deal of applied research in the developing countries, as well as for some basic research. Without applied research, it would be most difficult to transfer technology from one country to another. There are relatively few data that measure agricultural research in developing countries. Data from the 1948-63 survey of 26 developing countries by the U.S. Department of Agriculture are reproduced in Table 5. A parallel listing shows fertilizer consumption for the same countries. Obviously, research is important for fertilizer use to expand. A country needs at least one agricultural research worker for each 5-10 thousand farmers in order to have sufficient fertilizer information to found a sound fertilizer use programme. To summarize the human factor, there must be farmers who can at least read and write, there must be extension workers and/or salesmen who can tell farmers how to use fertilizers, and there must be research workers to tell the educators what to say.

LAND TENURE ARRANGEMENTS

Traditionally, in both developing and developed countries, fertilizer use and crop yields have been higher on land managed by owner-operators and by tenants who have a fixed rent per unit of land than by farmers who have a crop-share rent. Because of inflexibilities, crop-share

leases tend to favour the landlord more than the tenant. As a result the tenant has less incentive to use yield-increasing inputs such as fertilizer and better seed. For fertilizer use to increase, rental arrangements must be such that both the tenant and the landlord share in the increased output in the same proportion that they share the expenses. Where such arrangements are not made, fertilizer use and agricultural output increases more slowly than is needed in most developing countries. Statistics to support the fertilizer portion of this statement have not been located. However, Iranian data are available to show that tenure arrangements do affect crop yields (Table 6).

CAPITAL, CREDIT AND FINANCIAL INSTITUTIONS

Historically, the shift from subsistence farming to commercial farming has always required increasing use of capital. Few farmers are able themselves to finance the higher costs of improved seeds, fertilizers, agricultural chemicals, irrigation, mechanization and/or other practices that are used for increased production. To illustrate the change in demand for credit, Table 7 shows a 5-year projection for credit needs in India.

The data show that at the time of the projection, about half the farmers were borrowing - mostly from local moneylenders - in order to finance crop production. With the introduction of high-yielding varieties of rice and wheat and the government programme to intensify cereal production, it was expected that more and more farmers would have to borrow money. Presumably this projection was based on the estimate of the Sivaraman Committee on Fertilizers (Sivaraman et al, 1965). Using the retail price of fertilizer and tonnage estimates of fertilizer use, it is comparatively easy to calculate the amount of farmer credit that will be needed. It is much more difficult to supply the credit and to make it available through institutions that are attuned to farmer needs.

Crop production credit, however, is only a portion of the total credit needs for a progressive fertilizer programme. Distribution credit and manufacturing credit needs can be substantial. For example, marketing costs have been estimated to make up 22% of the consumer price of fertilizer in India (Warriar, 1969) and about a third of the selling price in the U.S. and Europe (Parker, 1969). Despite these fairly low marketing cost estimates, a Fertilizer Credit Committee in India estimated that distribution credit requirements could be as high as 90% of the retail value of the fertilizer (Rao et al, 1968).

TABLE 5

AGRICULTURAL RESEARCH AND FERTILIZER CONSUMPTION IN SELECTED COUNTRIES
(Anonymous, 1965 and 1972)

COUNTRY	AGRICULTURAL RESEARCH WORKERS PER 100,000 FARMERS	FERTILIZER CONSUMPTION kg/capita*
Taiwan	79	17.8
Yugoslavia	29	21.9
Greece	10	28.1
Spain	10	25.6
Iran	10	2.5
Colombia	9	5.9
Thailand	4.7	2.4
Pakistan	4.5	2.9
India	1.2	2.8

* *kg N + P + K/capita population*

TABLE 6

EFFECT OF TENURE ON CROP YIELDS IN IRAN
(Anonymous, 1965)

CROP	CROP-SHARE RENTAL	OWNER-OPERATED kg/ha	FIXED RENT
Wheat	735	883	931
Barley	680	798	1,244
Rice	2,164	2,325	2,281
Cotton	1,005	1,198	1,332

TABLE 7

EFFECT OF AGRICULTURAL MODERNIZATION ON NEEDS FOR FARMER CREDIT
(Patil, 1967)

CROP YEAR	FERTILIZER SOLD ON CREDIT % of sales
1966-67	50
1967-68	55
1968-69	60
1969-70	65
1970-71	70

Manufacturers also have credit needs, in the form of investment in physical facilities and of working capital. Fertilizer facilities require an initial investment equivalent to 10-25% of the annual retail value of the product. Annual interest costs are 8-10% so that this portion of the capital investment adds a negligible amount to the credit needs. Working capital, however, is more important. Working capital facilities (Bixby, Rucker, and Tisdale, 1966). Other estimates of working capital needs for various types of plants range from 15 to 30% of the estimated retail value of the product, calculated on a pre-tax basis (Russel et al, 1971 and 1973; Walkup, Waggoner, and Kresge, 1971).

Considering, then, the peak demand for credit for a progressive fertilizer programme, it is fairly safe to estimate that an amount equivalent to 150-200% of the retail value of the fertilizer must be available. Average credit needs are not meaningful. Peak demand is the critical value. Peak demand is that one instant in time, the one day of the year, that shows the maximum amount of money on loan for fertilizer. If a country cannot arrange for this credit to be available at the right time, at the right place, and in the right amount, the fertilizer programme will suffer. Because it is impossible to make precise credit allocations, credit requirements probably are best set at 200% of the retail value of the fertilizer and then reduced as circumstances within a particular country or region of a country might suggest. For example, if the national objective is to use 100,000 tons of fertilizer, valued at $100 per ton, there needs to be $20 million of credit available in some form or another.

The benefit/cost ratio is the relationship between the price a farmer receives for his crop and the cost of the fertilizer. That is,

$$\text{Benefit/cost} = \frac{\text{Value of INCREASE in crop yield}}{\text{cost of fertilizer}}$$

This is one of the most influential factors affecting fertilizer use. It is also the factor most easily influenced by government policies. Two variables enter into benefit/cost ratios: commodity value and fertilizer cost. Both can be controlled by government actions. Unfortunately, many governments promote fertilizer use by controlling the cost of the fertilizer. That is, fertilizer costs are subsidized. Admittedly, this will increase fertilizer use, but not necessarily on those crops that are in short supply. Were the government to control the price of commodities so as to provide high benefit/cost ratios for those crops that needed an expansion in production, fertilizer use still would increase and so also would production of essential food crops. In many situations, free market conditions prevail and fertilizer use must stand on its own economic merits.

When the benefit/cost ratio exceeds 1.0 only slightly, farmers usually will not use fertilizer. The risk is too high. A crop failure one year out of five would require a ratio of 1.25 to break even. There are no precise rules for determining the magnitude of the benefit/cost ratio needed to motivate farmers to adopt a new practice. Generally, it is thought the ratio should be at least 3.0 in developed countries where farmers are more accustomed to trying something new. In developing countries, where farming practices may not have changed for a century or more, the benefit/cost ratio must be much larger - possibly 6.0-10.0 - and must be easily observed before farmers will try something new.

Two other items required for calculation of benefit/cost ratios are the quantity of fertilizer to be used and the increase in yield that results from its use. Because the fertilizer response curve is very similar to a graph of the Law of Diminishing Returns, it is comparatively easy to adjust fertilizer application rates to provide any benefit/cost ratio that is desired. The principal difficulty is adequate research data to determine the exact shape of the response curve for many crops on various soils under a range of climatic conditions.

PRESENT YIELD LEVELS

Government officials and agronomists for commercial fertilizer companies should be thoroughly familiar with the present yield levels of indigenous crops because they affect the ease of attaining national crop production goals and fertilizer sales goals. A farmer's enthusiasm for fertilizer usually is in direct proportion to the increase in yield that he can observe or measure. If he is farming fertile soils, yield increases from fertilizer are likely to be negligible and the farmer probably will concentrate his efforts on some other input. Few farmers in developing countries are in this category. Most of them are farming soils that are very low in fertility, either naturally or as a result of long-continued cultivation and cropping. Fertilizer usually causes some rather dramatic increases in yields - but there are many exceptions, of course.

There are two quantitative statements that relate to yield level. Both appear to have originated from studies by F.W. Parker, who used FAO statistics for his studies (Parker, 1963; Williams and Couston,1962). The first statement is that fertilizer becomes essential when the national economy requires a level of agricultural production equivalent to 800-1,200 kilograms of cereal grain per hectare. The second statement is that countries using 20 or more kilograms of plant nutrient per hectare of arable land have satisfactory or very good levels of food supplies and human nutrition. (Some countries have satisfactory supplies, when using less than 20 kilograms of plant nutrients per hectare but no country has unsatisfactory supplies when using 20 kilograms or more). Table 8 illustrates the progress of the three CENTO countries toward satisfactory food supplies when measured by this standard.

TABLE 8

PLANT NUTRIENT USE IN THE CENTO COUNTRIES
(Anonymous, 1972)

COUNTRY	1948-53	1962-63	1971-72
	kg/arable ha		
Pakistan	0.2	5.7	14.6
Iran	?	0.8	6.2
Turkey	0.6	2.7	17.4

SIZE OF FARM HOLDINGS

The size of farm holdings is important for two reasons. The most important is the effect on communications. An extreme example is used to illustrate the effect. Suppose that all the farmland in the three CENTO countries were owned by just one man. It should then be a comparatively simple matter to educate just one man about fertilizers and to keep him informed about the new developments. This, of course, is not the case; rather, the CENTO countries have an almost impossibly large number of farmers. Each farmer needs to be taught how to use fertilizer properly but this is not possible because of the limited number of extension workers. There is a possible solution to this dilemma. Moroccan data are used to illustrate the solution (Table 9). Avoiding for the moment all social and political considerations, the obvious procedure is to concentrate the fertilizer programme on the modern farms and the traditional farms larger than 10 hectares. Almost exactly 50% of the arable land would be in the programme but less than 6% of the farmers would be involved. As these farmers become more and more knowledgeable about fertilizers, the educational programme can be shifted to farmers in the next size class.

TABLE 9

NUMBER AND SIZE OF FARMS IN MOROCCO
(Kelso et al, 1967)

TYPE OF FARMING SYSTEM	FARM SIZE	NUMBER OF FARMERS	TOTAL FARM AREA
	ha		1,000 ha
Traditional	0 - 4	885,500	1,200
	4 - 10	165,500	1,100
	> 10	56,000	1,100
Modern	0 - 50	1,500	50
	50 - 500	3,000	800
	> 500	600	600

Socio-political considerations suggest that a pure economic approach cannot be adopted. Some attention must be given to the very small land holder. An effective programme can still be conducted if extension agents are assigned on the number of farmers to be serviced rather than to land area. Using the same Moroccan data (Table 9), compare the land area that would be serviced if one agent worked with 50 traditional farmers with less than 10 hectares and another agent worked with traditional farmers, operating more than 10 hectares. The first agent would service about 100 hectares while the second would be working with about 1,000 hectares. No one could deny that the agents were not equitably distributed among the active farmers yet the second agent is very likely to promote the use of even more than ten times the amount of fertilizer as the first agent.

Size of farm holdings is important from still another viewpoint. There is a very high correlation between size of farm and extent of mechanization. Many people have commented that mechanization is undesirable for agriculture in developing countries because it displaces too many people from the land. This is not an acceptable philosophy. No man should be required to provide hours and hours of back-bending labour in order to reap a few handfuls of grain for his family. There is an easier way - and the sooner this easier way can be used, the better off mankind will be. It is true that mechanization releases a lot of labour from the farming sector. But, commercialization of agriculture creates new jobs in the transportation, food processing, implement manufacturing, administrative, and other sectors. These jobs rightfully belong to the people released from the agricultural sector. Government officials should make certain that educational programmes are available for retaining displaced agricultural workers so that they can qualify for the new jobs.

SUMMARY

The objective of this presentation has been to quantify the six major restraints of fertilizer use and to present specific information rather than generalizations. Some of the data are tenuous and probably need some adjustment before they can be applied to the three CENTO countries. Nevertheless, they can serve as starting points in a country-by-country evaluation. These restraints are reiterated in the form of nine major questions:

1. Does your country have a literacy of 50% or higher? How many years will be required to reach this level of literacy with the present educational programme?

2. Does your country have at least one extension worker per 1,000 hectares of arable land or per 1,500 farmers? If not, how many years will it take to reach this level? Are the commercial fertilizer programmes designed to supplement the extension programme with knowledgeable salesmen?

3. Does your country have at least one agricultural research worker for each 5-10 thousand farmers? If not, how many years will be required to reach this level? Are the commercial fertilizer companies prepared to fund some of the research?

4. Does your country have a high proportion of farmers who own and operate their own farms or else rent on a fixed fee basis? Do you have land programmes that encourage ownership by farm operators?

5. Do you have credit institutions that can service the manufacturer, the distributors, and the farmers? Are total available credits about double the retail value of the fertilizer projected for use?

6. Do your farmers receive at least a 6.1 return on their fertilizer investment on those crops that require expanded production?

7. Does your country have excess land that can be placed into production or must production be upped to at least 800-1,000 kg of grain per hectare?

8. How many years will it be before your country is using 20 kilograms of plant nutrients per arable hectare? How fast must the rate of fertilizer application be increased in order to keep up with expanding population and increasing demands for food?

9. Are your government educational programmes and fertilizer sales programmes designed to quickly convert large farms to commercial agriculture or are they faltering because of misplaced emphasis on the very small farmer?

If any country has answered "yes" to all these questions, it was not necessary for that country to attend this seminar.

Dr. Russel is an Agriculturist at the Division of Agricultural Development, Tennessee Valley Authority.

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The Philosophy of Fertilizer Distribution and Storage Schemes

Mr. K.E. Smallpage

Although there are, obviously, differences in scale and timing the basic problems associated with the storage and distribution of fertilizers are common to most countries and thus I trust you will accept as relevant the use of the United Kingdom's experience as the basis of this paper.

Briefly, the U.K. farms approximately 30 million acres comprising 60% grassland, 30% cereals and 10% root and miscellaneous crops, excluding rough grazing. The total usage of fertilizer is approximately 5 million tons of product per year of which 3 million tons are compounds and 1 1/2 million tons straight nitrogen.

The prime distribution problems are:-

(i) The bulkiness of the product. Average concentrations are compounds 42% and straight nitrogen 29%.

(ii) Seasonality of use, at best twice a year for arable crops and the more frequent use on grassland confined to the intensive farms.

(iii) Characteristics of the product - susceptible to moisture, sunlight and segregation.

(iv) Location of factories in relation to farms.

(v) Access to farms; narrow and poorly surfaced roads.

Adding to these problems is the unpredictable disruption of the pattern of offtake by price and subsidy changes.

HANDLING THE FINISHED PRODUCT WITHIN THE FACTORY

To ease the distribution problem and reduce costs, the industry has gradually increased concentrations to present levels, and at the same time, moved away from the bulk storage and handling of fertilizers to the immediate bagging of all high analysis products immediately after manufacture. At the present time, 2/3rds of the U.K. fertilizer production is stored in bags (sometimes for an appreciable period) before delivery to the customer.

There are a number of reasons for this trend, some of the more important being:

1. the increased use and high levels of urea or ammonia nitrate in fertilizer compounds;

2. improvements in manufacturing methods leading to improved storage properties;

3. the high cost of air-conditioned storage necessary for the bulk storage of high analysis fertilizers;

4. the decentralization of fertilizer storage away from the Works into merchants or farmers own stores;

5. optimization of bagging plant capacity, saving capital and manpower;

6. the increasing practice of blending straight to bagging to avoid segregation of blend compounds;

7. better customer service, by reducing the loading time for lorries, and;

8. the present limitations in bulk handling on the farm.

In overall terms, bagged storage requires 10% to 15% more area, but saves 25% to 30% on the overall capital cost of a storage and bagging installation.

Block stacking makes the maximum use of space but the rate of handling is slow, consequently the greater part of our bagged stocks are stored on pallets. Our pallets are wooden and take as standard a 30 cwt. load consisting of five layers with six sacks to a layer. Depending on the lift height of the fork lift truck our stacks are five or six pallets high: a fork lift with a side shift attachment giving 5" sideways movement of the forks improves the truck's performance and the quality

of the stacking.

At some of our Works we have installed automatic palletizers which Fisons have developed to place the filled bag on the pallet in such a way that the bag seal is always to the centre of the pallet.

Undercover storage is preferred but outside storage can be quite satisfactory when properly sheeted and on a suitable site. A recent introduction is the covering of the loaded pallet with a plastic cover or the use of shrink wrapping. Both give weather protection and preserve the bags in clean condition.

MOVEMENT OF FERTILIZER FROM FACTORY TO FARM

Some 75% of fertilizers are applied to crops on the farm in March and April. However, as a result of offering a series of cash and credit early movement allowances actual farmer purchases are much more even with a maximum offtake in any one month of only 25%.

The Spring peak is ironed-out by operating a storage scheme with our merchants (wholesalers) in which we use their premises for storage. In a year with no price changes, we can deliver half the tonnage in June/December with the remainder in the Spring months.

OUTLETS

Fisons trades mainly through Agricultural Merchants. About two thirds of the overall fertilizer tonnage in the U.K. is distributed through merchants, with the remainder being sold directly to farmers.

In distribution terms the role of the merchant is vital.

(i) He buys grain and other produce from the farmer and in turn sells him fertilizers, feeding stuffs and other items. Therefore some degree of loyalty exists between the merchant and the farmer and the merchants' influence in achieving a sale is very significant.

(ii) The merchants' lorries and stores play an important part in the movement of fertilizers onto the farm.

(iii) The merchant carries a large amount of farmer credit thus relieving the manufacturer of this cost.

Fisons also owns a direct selling subsidiary, Hadfields, where we substitute the selling alternative for the cost of greatly increased storage responsibility.

METHODS OF DELIVERY TO FARMS

Basically, delivery to a farm from a Works occurs by four possible routes:-

(i) A relatively small proportion is delivered direct to farm and in some cases where the farm is located near the Works, the farmer collects the fertilizer himself.

(ii) A large proportion is delivered from the Works into a Fisons store from where the merchant collects and delivers tonnage to farms or into his own store.

(iii) The merchant takes delivery into his own store direct for delivery out to the farm in the Spring. Much of this is collected by lorry but a proportion is delivered from Works in train loads to nearby stations (average size 120 tons).

(iv) At the start of the season, train loads of fertilizer are despatched to the nearby station where the merchant either arranges delivery to the farm or takes the fertilizer into the store.

Possibly the biggest change that has occurred in distribution has been the big swing in tonnage going through stores rather than from the Works. Five years ago only 10% of Fisons tonnage went through stores - now it is about 40%. This change has arisen primarily from competitive developments in the market and the need in such a situation to have greater control by the manufacturer.

Increasing competition in the fertilizer industry, stricter regulations on the use of lorries, the transfer of feeding stuff manufacture inland to the grain producing areas, and rapidly rising costs of haulage have prompted merchants to limit the distance of their single journeys. Consequently we now have to have a comprehensive hired stores network - from which no haulage allowance is given - to support the works outlets where we still apply a haulage contribution.

Most Fisons stores are hired on a ton per week basis, which avoids tying-up capital, keeps costs down because we only pay for what we use, and preserves flexibility in the network.

STOCK CONTROL

Our present despatch points consist of:-

9 factories
8 major stores
60 minor stores

through which, because of our policy of strong product branding with specific analyses for individual crops, we have to handle some 90 different products.

Obviously this has presented us with a major problem. Our solution was to classify stores by capacity of number of products into large (unlimited), medium (up to 18) and small (11 or sometimes less). To establish which grade should be stocked, a review was made of previous sales over four monthly periods.

The present system is that the computer-generated forecast selects the highest monthly figure for each grade and fixes a re-order level at the sales point of 75% of forecast, with a further $37^{1}/2$% as back up at the supply point.

When stocks pass the re-order level, "target stocks" are calculated in proportion to stock required at the beginning of the next four-month period.

The benefit of computerization is that it provides an objective calculation of stock levels. This in turn provides extensive benefit to Accountants/Production Planners to calculate raw material requirements, etc. It also allows rationalization of works to specialize in the grades they are best able to produce or appropriate to a particular geographical area.

HANDLING AND FERTILIZER APPLICATION ON THE FARM

When considering the problems of handling and distributing fertilizer on the farm it is worth remembering that so far as bulk and volume

are concerned the arable farmer has a far greater problem with his crops than he does with his fertilizer. In the U.K. we apply compound fertilizer at the rate per acre of:-

WHEAT	3 cwt	yielding	2 tons per acre
SUGAR BEET	7 cwt	"	15 tons per acre
POTATOES	10/12 cwt	"	15-20 tons per acre

Thus the farmer in his own interest will seek to improve his roads and handling system. Nevertheless, many farms are still inaccessible to large modern vehicles and we have to retain the facility to deliver in comparatively small loads.

PALLET HANDLING

Many of the larger farms are moving onto a pallet handling system because labour costs can be reduced by half when compared with normal methods. However, this can involve a high capital investment. We have found that generally speaking the use of pallets is preferable when the farm is handling at least 100-120 tons of fertilizer. In addition where the farmer is growing crops such as potatoes which are stored in boxes or sacks then the pallets offer an integrated system.

Fisons operate a Pallet Exchange Service which is basically a rental scheme. The 30 cwt pallets become the property of the customer in the fourth year of his involvement in the scheme. During the first three years, he pays one pound (sterling) per pallet per year. This makes initial participation in the scheme easy, due to the low capital outlay on pallets. In exchange for this service, Fisons naturally expect a tonnage commitment over the period of the Agreement.

There is now a wide choice of 30 cwt fork-lift attachments and trucks available - both new and secondhand. Perhaps the most popular are the front and back mounted tractor machines which are relatively cheap and versatile. However, an increasing number of bigger farms are equipping with industrial fork-lift trucks.

FISONS QUICK-SLINGS

These enable a farmer to improve his fertilizer handling efficiency without undue capital expenditure. Basically each sling is made up of a

nylon strap with an easy fixing buckle and a self-opening loop. This goes round a base-board which helps to make the load more stable. Each sling carries 10 cwt. They can be easily handled by using a special attachment to a normal fore-loader on a tractor. They are very stable and can be stacked up to 3-4 high depending on the loader being used.

We have recently introduced a special pallet at some of our stores which enables Fisons to load and carry two slings at a time using a fork-lift. The reduction in handling time within the store and onto the lorry is significant over handling individual slings. The pallet is so designed, being four-way entry, that full pay load can be maintained on the lorry. On arrival at the farm the fertilizer can be easily off-loaded and the pallet returned to store.

BULK HANDLING

The use of bulk fertilizers on the farm is presently not very widespread. This is due to the following reasons:

1. The difficulty of stock control on the farm with a bulk heap.

2. Concentrated compounds will store best in bags.

3. In addition to providing good storage, the polythene bag gives the farmer a useful form of measure when applying fertilizer to the land.

4. It should be acknowledged that U.K. manufacturers are not generally geared to the handling of bulk fertilizers having preferred to move into palletizing and other methods of handling.

However, some farmers do operate a very efficient scheme provided the store has a sound floor, strong walls and is water-proofed with a bitumen compound. In some situations, it is possible to load up 30 cwt of fertilizer into a spreader in 3-4 minutes.

LIQUID FERTILIZERS

We do, of course, have some usage of liquid fertilizers and anhydrous ammonia in the U.K., but these currently account for only 5% of fertilizer consumption. The relatively small demand in this sector has again been due largely to developments in the mechanical handling of solid fertilizers.

FISONS HANDLING CONSULTANCY SERVICE

This is a comprehensive systems analysis to provide the least cost system for the farmer covering the following:

1. Delivery into farm store.

2. Handling from the store to the field.

3. Application on the field.

Although the handling of fertilizers is becoming increasingly more mechanized on the farm, there is still a large proportion of fertilizer bags handled by farm labour. Even within this system, it is often possible to reduce costs by placing fertilizer bags in strategic positions ready for use during the sowing period. For example, a platform can be constructed out of old railway sleepers near the fields. The fertilizer can be delivered directly and therefore, handling in and out of the farm store is avoided. Furthermore, the platform is sufficiently high to enable easy tipping of the bags into the spreader machine.

A slightly more mechanized approach would be to use an elevator which removes part of the manual handling. Even this can reduce the loading time by half.

Fisons handling consultancy service will also advise on the use of greater mechanization in fertilizer handling.

CONCLUSION

In brief, I believe the solution of the main issues lie in:

(i) Concentration of product;

(ii) packaging and mechanical handling;

(iii) cheap, simple storage facilities in the agricultural areas;

(iv) inducement for the wholesaler or farmer to take in fertilizer before it is required for use; and

(v) the ability to make full use of modern transport from factory to farm.

Mr. Smallpage is the Senior Administration Controller at Fisons Limited.

General Trends in Fertilizer Marketing

Mr. K. F. Isherwood

This paper comprises a comparative analysis of recent trends in fertilizer marketing in the United States and western Europe. Current changes in developing countries are not considered but they are taken into account in the design of the paper since it is felt that recent developments in the old, established markets could contain useful lessons for newer markets currently being established or reorganized. A selection of publications concerning fertilizer marketing in developing countries is given in the references and this paper relates particularly to the publication by E.O. de Guia of the O.E.C.D.*

Two aspects of marketing are examined. The first (A) concerns changes in the forms of the fertilizers marketed. The second (B) concerns the fertilizer marketing systems. In both cases developments since about 1960 are considered.

The following definitions are given to avoid confusion, especially between American and European terminology;

> *Straight fertilizers:* contain only one of the three primary nutrients.

* *Organization for Economic Co-operation & Development.*

The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of member companies of ISMA Limited.

Compound fertilizers: contain more than one of the primary nutrients, regardless of form or manufacturing process.

Bulk-blends (U.S.A.): compounds which are physical mixtures of two or more granulated fertilizer materials such as ammonium phosphate, triple superphosphate, ammonium nitrate, muriate of potash, etc.

Complex fertilizers (Europe): compounds with nutrients at least partly in chemical combination and with all the nutrients present in each granule. Normal NPK or NP grades.

FORMS OF FERTILIZERS

The consumption of fertilizer nutrients has more than doubled in both western Europe and the United States since 1960. This growth has been accompanied by the following trends:

Compound and straight fertilizers: in the cases of P_2O_5 and K_2O, the whole of the increase in western Europe and a large part of that in the United States was in compound form. In the case of nitrogen, half the increase in western Europe and more than three quarters in the United States was in straight form. In the United States about 60% of the increase in straight nitrogen consumption was accounted for by anhydrous ammonia whereas in western Europe, solid calcium ammonium nitrate and later ammonium nitrate predominated.

2. Nutrient concentration: there was a steady increase in the average nutrient concentration of both compound and straight fertilizers in both regions over the period, with the growth accounted for largely by materials of relatively high concentration. The consumption of low concentration straight materials such as single superphosphate (about 20% P_2O_5) and sulphate of ammonia (about 21% N) has remained approximately constant or declined.

3. Bulk handling: there was a substantial increase in bulk handling in the U.S.A. and today only about one third of all fertilizer materials are bagged. Bulk handling has also been developed in western Europe but to a much lesser extent, and a large proportion of fertilizers consumed in western Europe continues to be handled in bags. In the USA, bulk liquids (apart from anhydrous ammonia) were developed as well as bulk solids but liquids still account for only a very small proportion of total fertilizers used in western Europe, and this development appears to be slowing down even in the United States.

The increased popularity of compound fertilizers is easily explained by their greater convenience and improvements in their quality in recent years. They have been readily accepted by farmers, merchants and manufacturers alike. The separate application of straight nitrogen is due partly to agricultural factors, such as application to grassland and top-dressings on arable crops. In the United States the relative cheapness of nitrogen in anhydrous ammonia has had a substantial impact.

In order to explain the other developments it is useful to examine the total costs of supplying fertilizer nutrients from factory to the field, i.e. from receipt of the raw materials by the manufacturer to their application on the land. Two such cost structures,* each involving physical handling by the retailer, have been published (Laehder A.D. [1970] and FAO/FIAC [U.K. section] 1972/73). There are, of course, countless possible variations but in spite of the very great differences between conditions in the U.S.A. and U.K.,these two cost structures both lead to similar overall conclusions, both with demonstrating the importance of distribution and handling costs. The U.S. study found that only 47% of the total mine to farm cost of diammonium phosphate was due to primary and secondary manufacture. Not all the remaining 50% or so comprises costs which are affected by changes in the form of fertilizer, but if items such as interest, sales and administration, profit margins, etc. are excluded, there still remains 20% to 30% due to costs of handling, storage and transport, costs which can be influenced by the fertilizer form. A great deal of attention has customarily been paid to processing (excluding raw material) costs but a survey we carried out a couple of years ago indicated that these would be $8 or $9 per ton of 15-15-15. The 20% to 30% mentioned above could amount to $20 to $25.

Now, savings in handling, storage and transport costs are approximately proportional to an increase in the nutrient concentration of the fertilizer. A 1:1 $N:P_2O_5$ mixture made from ammonium sulphate and superphosphate has a nutrient concentration of 19%. One based on ammonium phosphate and ammonium nitrate has one of 51%. Without the increased concentration the $25 mentioned above could be $67 today, for the equivalent quantity of plant nutrients.

This is, perhaps, an extreme example but it illustrates the point. There seems little doubt that the concentration factor is a major explanation of the ability of fertilizer manufacturers to keep fertilizer prices down, at least until recently, in western Europe and North America. In turn, the relative cheapness of fertilizers has undoubtedly played its part in achieving the growth noted at the beginning of the paper.

* *These cost structures do, of course, pre-date the recent increase in raw material costs.*

In the U.S. cost breakdown, 17% of the retail price was accounted for by transport costs. The distance involved is substantial, say 1,500 km to the Corn Belt. This partly explains the rapid development of the bulk-blending system which allows the transport of highly concentrated fertilizer materials, such as ammonium phosphates, over these considerable distances and direct to the bulk-blending plants. These plants are normally relatively small units, handling say 3,000 tons of fertilizer per annum, mixing the fertilizer materials in proportions suited to local requirements and serving the immediate locality. A very complex storage and transport system has been developed in order to minimize the costs involved. In western Europe it is concentration of complex fertilizers which has shown a dramatic increase of concentration with consequent savings in storage, handling, bagging and transport. The average transport distance in western Europe are much less than in the United States but the costs still amount to a significant $5 or $6.

In some countries the rate of increase in the average concentration of complex fertilizers is starting to slowdown. At a certain point the cost of achieving a further increase of concentration exceeds the benefits to be gained. The higher the concentration the greater the cost of achieving a further increase and the less the resultant saving. It is easy to show arithmetically that an increase from 30% to 40% gives twice the saving of an increase from 50% to 60%.

An interesting question is why compounds have developed as bulk-blends in the U.S.A. and complex fertilizers in western Europe. The long distances in the U.S. and the flexibility of bulk-blends are not the complete answer; bulk-blends also have their disadvantages and costings indicate that a modern complex fertilizer plant could supply nutrients to the farmer as economically as bulk-blends, even under U.S. conditions. The answer may lie in commercial developments. In the 1950's the U.S. fertilizer industry was dominated by a large number of relatively small-scale compound fertilizer producers, (probably averaging less than 20,000 tons of fertilizer per annum) distributing within their own area, taking their supplies from large producers of the basic materials and distributing their products through small, independent dealers. Their compounds were of relatively low concentration. Towards the end of the 1950's they started to merge and nationalize but failed to appreciate the economic advantages of higher concentration and the possibilities which already existed of supplying more concentrated materials to the farms. Then, in the early 1960's, some large companies entered the industry; they invested substantially in both production capacity and distribution outlets, especially in bulk-blending outlets. The compound manufacturers, with their out-dated product and distribution system, stagnated or went out of business.

This development did not occur in western Europe. Manufacturers have been constantly rationalizing their industry and increasing the efficiency of their operations. Their high-grade complexes, produced in large, integrated plants, can compete effectively with alternative systems.

The above comments have concentrated on the cost benefits of higher concentration, but there are other advantages. In some countries the transport of today's quantities of nutrients in fertilizers of the concentration of a decade ago would cause conceivable difficulties. The farmer, too, benefits greatly from the greater ease of handling, saving not only costs but, more important, effort and time at busy periods of the year.

The concentration factor also helps to explain the rate of development of the more concentrated straight nitrogen fertilizers such as ammonium nitrate, urea and, especially in the U.S.A., anhydrous ammonia (82% nitrogen). It is interesting to question why the very highly concentrated anhydrous ammonia has not developed to the same extent in Europe as it has in the U.S.A. The reason for its popularity in the United States is largely because it is by far the lowest cost form of nitrogen. Furthermore, the large fields, level terrain and crops of the major arable areas are well suited to its use. In Europe its use has developed substantially only in Denmark. Conditions are suitable for the use of ammonia in Denmark but it is also interesting to note that NPK complexes developed somewhat later in Denmark than in most other European countries, almost in parallel with ammonia. We have not studied in detail the reasons for the slow development of ammonia in other parts of Europe but it does appear that Denmark is not typical of the situation elsewhere. The cost advantages resulting from the high concentration are partly offset by the need for specialized transport and application equipment. In most countries contract application of fertilizers is not well developed. It is suspected that modern complex fertilizers can compete economically with an autumn application of a PK fertilizer followed by ammonia in spring, in most European countries.

The other major development in the United States which has not been matched in western Europe is that of bulk handling. The factors which have encouraged bulk handling are those already mentioned for bulk-blends. Another factor is that the dealer in the U.S.A. also welcomes the opportunity to expand his services by offering bulk contract spreading facilities. (Bagged fertilizer still predominates in the areas of smaller farms and rough terrain). In western Europe, bulk handling has been developed to a substantial extent only in Denmark, France, Germany and Sweden. In Denmark, some 30% of complex fertilizers are handled in bulk,in Sweden and Germany about 20% and in France somewhat less. Handling in bulk gives an immediate saving in the cost of bags and bagging

(say $4 per ton) and may halve the handling costs between factory and farm (say a saving of $2 per ton). However, bulk fertilizer presents greater problems, and hence costs of storage, and therefore of distribution. It has proved successful only in richer arable areas where considerable attention has been paid to the careful planning of distribution and storage. The cost savings can easily be offset by additional expenses and the system tends to be more advantageous to manufacturers and dealers in regions where there is an absolute shortage of labour. Bagged fertilizers have the very considerable advantages of ease of storage, requiring little special investment on the part of the farmer, and ease of measurement for application. The advantages of bulk handling over a modern system of bag handling (e.g. on pallets) are therefore, not as clear-cut in western Europe as in the U.S.A. One factor which has favoured bulk handling in some countries is the opportunity it gives of offering farm services, just as in the United States.

THE DISTRIBUTION SYSTEM

The most marked changes in the distribution system have occurred in the United States. During the 1950's the typical dealer was a relatively small, independent merchant handling a variety of agricultural requisites. Towards the end of the 1950's and during the early 1960's there was considerable rationalization and a few retailers were acquired by the compound fertilizer manufacturers. Then the large companies entering the industry from the early 1960's acquired or established "controlled outlets" on a large scale, largely bulk-blending units, and to some extent there was over-investment in this sector just as there was in production facilities. The number of bulk-blending units increased from 400 in 1960 to over 5,000 in 1970. It does appear that the policy was pursued without adequate evaluation of the costs involved and the sales prospects, i.e. a failing which previously led to the eclipse of the traditional compound manufacturers.

There has also been rationalization of the retail sector in western Europe, as well as of the manufacturing sector, but it has proceeded at a much steadier pace. Manufacturers have, on the whole, avoided investment in the retail sector in Europe.

In recent years there has been an increase in the demand from farmers for services such as soil testing, advice and consultancy, in both the U.S.A. and western Europe. These services may be provided by the manufacturers and/or dealer. The manufacturer in any event pays considerable attention to the training of the dealer. These services are an important means of promoting fertilizers and in some countries there has been a move away from brand promotion. The provision of services is highly developed in the case of bulk-blending; soil testing and pres-

cription-blending are basic to the blender's business. He also normally offers custom-spreading services.

The cost structures mentioned earlier in the paper, indicate that the manufacturer might spend $4 or $5 per ton of fertilizer on selling; i.e. sales force, advertising and services, representing about 5% of the retail price. Further expenditure is incurred by the dealer. The proportion of the dealer's costs which should be allocated to selling is difficult to define but the total costs typically incurred by the dealer on labour (including selling), maintenance, depreciation, losses and transport to the farm, but excluding interest on stocks or credit, appears to be about $11.* The effort put into selling in western Europe and North America, and hence its cost, appears to exceed substantially that incurred in most other countries. Since this development has occurred during a period of intense competition it can be inferred that the money is well-spent.

Another feature of the marketing of fertilizers in western Europe and the United States, is the universal use of the price structure in the form of discounts (up to 10% or even 15% of retail price) for out-of-season purchases. These discounts are calculated with a high degree of precision in order to achieve the objective of easing distribution problems during the peak season, minimizing storage by the manufacturer and hence making continued production possible. The use of the price structure for this purpose appears to be the exception in developing countries.

Significant discounts for the purchase of larger quantities of fertilizer are offered in many countries and there are other savings to the dealer from handling larger quantities. The ability to make optimum use of discounts can be important to the profits of the dealer and this factor, together with the increasing farmer demand for services, no doubt has an influence on the rationalization of the retail sector.

Adequate credit has long been available to farmers and dealers in the U.S. and Europe, and is taken for granted as an essential part of the distribution system. In general, manufacturers try to avoid serving as a credit source for the farmer but in some countries they do provide credit to the dealer. The farmer can normally obtain adequate credit from the financial institutions or the retailer.

In conclusion, listed below are some salient points from this study which could conceivably be relevant to newer markets:

1. Inadequate analysis of the full costs of marketing fertilizers from factory to field, contributed to misjudgements even in a

* *In cases where the fertilizer is handled physically by the dealer.*

market as highly developed as that of the U.S.A. Another factor is that the sales forecasts on which strategy is based need to reflect what is going to happen in practice.

2. The reasons for the success of new fertilizer handling systems in a given region may not be those which are first apparent and their indiscriminate adoption could lead to wasteful investment. The European industry has adopted some American developments, but very selectively.

3. The increase in the nutrient concentration of fertilizers has led to considerable cost savings and was probably a major factor in holding down fertilizer prices in the U.S.A. and Europe; this, in turn, no doubt contributed to the substantial increase in fertilizer sales over the period.

4. The use of out-of-season discounts to even-out the distribution of fertilizers and avoid problems at the time of peak demand is highly developed and universal in the U.S.A. and western Europe.

   The necessity of adequate credit is taken for granted.

5. Selling costs appear to be higher in western Europe and the U.S.A. than in most other countries, partly because of the high standard of the farmer services provided. Expenditure on effective selling appears to be money well-spent and the farmer is the ultimate beneficiary.

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Mr. Isherwood is an Agricultural Economist at the International Superphosphate and Compound Manufacturers' Association Limited.

A Comparative Analysis of Fertilizer Marketing in Selected Countries

Mr. Karl Wierer

AN APPRAISAL OF THE MARKET SITUATION

The level of fertilizer consumption is an indicator of agricultural development. The annual fertilizer consumption in different countries ranges from a few thousand tons of nutrients, to more than a million tons. The fertilizer marketing and distribution system, of course, reflects the respective levels of consumption and in countries with low consumption levels, wholesalers, retailers and sub-dealers, deal with limited volumes which tend to result in rather expensive operations and relatively high prices for the farmer. Many of the consuming countries have no domestic fertilizer production and rely on imported supplies. This leads, in practice, to several complications where there are restrictions on foreign currency purchases and rather complicated procedures have to be followed to get the fertilizer imports approved. This not only discourages fertilizer dealers, but it also results in late arrivals of fertilizers at the destination, perhaps even at a time when they are no longer needed.

Domestic fertilizer production is not only a question of availability of raw material, it is even more a question of availability of market outlets. Fertilizer production plants require large investments and have large capacities. In most cases, the smallest nitrogen plant must have an annual capacity of at least 50,000 tons of nutrients. In many countries where new fertilizer plants have been recently established, the capacity is under-utilized. From a nitrogen plant in northern Thailand, it is reported that the total capacity of about 54,000 tons of nitrogen per year is used only at 30-40 per cent. In most of these cases, the sales potential of new plants was over-estimated and the strength of competitive suppliers was not sufficiently considered.

TABLE 1

FERTILIZER MARKET SITUATION IN SELECTED COUNTRIES

	NETHERLANDS 1970	THAILAND 1971	IRAN 1971	JAPAN 1969	NEPAL 1971	HUNGARY 1971
Total consumption 1,000 tons of NPK	616	97	163	2,241	8	925
Annual growth rate of consumption, %[a]	2	20-25	27	3-4	8	15-20
Level of consumption kg. NPK/ha[b]	254	10	50[c]	200	1	150
Percentage of components	29	80	10	75	55	28
Imports, percentage of total consumption	20-30[d]	85	15-20	20[d]	100	34

a *Based on the growth of the last decade;*

b *Kilo per hectare of cultivated land;*

c *Kilo per hectare of irrigated land only;*

d *Mainly potash.*

SOURCE: FAO/FIAC series of case studies on fertilizer marketing in selected countries.

It is worthwhile to mention here a general problem of economic development which exists in many countries where large efforts have recently been made to speed up development. Development plans for production have been given too much emphasis and very little attention was paid to the establishment of an efficient distribution system. This is not only true of fertilizers but of agricultural commodities in general.

It cannot be repeated often enough that all agricultural and industrial development plans should give balanced consideration to the goals of sufficient production and efficient distribution.

Although in many countries actual fertilizer consumption is rather low, the markets are dynamic and the annual rate of increase correspondingly high. In a country like Iran, the annual growth rate of demand has been between 15 and 20 per cent. If this growth were to be maintained, the present annual consumption of about 60,000 tons of nutrients would be doubled within five to seven years. On the other hand, in countries like the Netherlands or Japan where the present level of consumption is already high, annual growth rates are rather limited, generally below five per cent.

In the demand analysis, close attention must be given to the different types and kinds of fertilizers needed. The most significant fact in this sphere is probably that during recent years compound fertilizers have gained a large share of the market. This does not mean, however, that an increasing level of fertilizer consumption runs parallel with the increasing use of compounds. In Thailand compounds count for about 80 per cent of total consumption; in the Netherlands only for about 30 per cent. The use of compounds offers several advantages. Due to the high nutrient content, the transport costs are considerably reduced. Another advantage is its easy application and the wide choice of mixtures suitable for various crops under different situations. On the other hand, it should be mentioned that the soil conditions in a country such as Iran require nitrogen and phosphate fertilizers, whilst potash is relatively unimportant. In most European countries the use of compounds is limited, since a large part of the phosphate and potash fertilizers are mostly used in Spring.

A second important trend to be observed is the increasing share of urea among the various nitrogen fertilizers. Also, in this case, considerable transport costs are saved due to the high nutrient content (46%). In a country like Thailand, about half of the total nitrogen consumption is in the form of urea.

Another important aspect of the demand analysis is the structure of agricultural production. It can be observed that fertilizer use is often concentrated in certain sectors of agriculture only, or in certain regions. More than three-quarters of the fertilizers used in Iran are on irrigated lands, whereas in Thailand 60 per cent are used for rice while in countries such as the Netherlands they are generally used for all agricultural crops.

THE LEVEL OF FERTILIZER USE IN RELATION TO THE MARKETING SYSTEM

When the fertilizer consumption level and the development trends are analyzed, it seems that the situation in various countries or regions can be basically grouped into three phases. These three stages of fertilizer use development are closely related to the organization of the fertilizer marketing system and within the individual phases, changing emphasis has to be given to determined marketing functions. The three phases may be characterized as follows:

a. *Initial stage* - The present level of consumption is very low and the rates of increase are also still moderate. In this phase, fertilizer marketing has to be integrated as far as possible into the general agricultural marketing system in order to minimize the fixed and administrative overhead costs. Local village dealers should be encouraged to include the sale of fertilizers in their general business. Since in many cases the use and benefits of fertilizers are often not yet fully known by the farmers, sales policy should be largely based on promotion and extension programmes. It is important that private dealers be involved from the beginning in the extension programmes in order to adjust their business gradually to the increasing demand. Based on the projected fertilizer consumption, needs for marketing facilities and organizations have to be determined, and resources for implementation of the respective programmes have to be obtained.

b. *Taking-off phase* - Promotional means and extensions have stimulated farmers to use fertilizers increasingly. The annual growth rate of fertilizers is rather high. In this phase the extension and promotion for the farmer is continuing. However, more importance should be given to the organization of the marketing system, sales campaigns and training of fertilizer distributors. Also, logistics such as transport and storage, especially at the retail level, have to be gradually expanded bearing in mind that shipments from factory to farmer should be as direct as possible.

c. *Advanced development* - Fertilizer consumption has reached a high level and the annual growth rate has slowed down. Promotion and sales organization is being maintained and increasing importance is being given to the rationalization of the present marketing system, the development of new products and the introduction of new techniques. The larger volume of business

gives scope for the further integration of marketing operations: retailers and wholesalers can often establish associations in order to strengthen their market position and to cut costs and increase efficiency.

THE ORGANIZATION OF A FERTILIZER MARKETING SYSTEM

An increasing use of fertilizers is largely based on the organization of an efficient marketing system, which assures that they are brought at the right time, to the right place and at the lowest possible cost. The fertilizer marketing system depends, of course, upon the size of the national market and upon the volumes handled. Since fertilizer consumption is growing in most countries the marketing system has to be very flexible to provide for rapid expansion and change. The fertilizer marketing system, especially at the retail level is closely associated with the general agricultural marketing system.

The type of marketing system depends largely on the structure and location of the fertilizer industry, as well as on the structure of agricultural production. In the case of Iran, the fertilizer industry is located in the south of the country, the main agricultural areas are in the north and distances of more than 1,000 kilometres have to be covered. This means that considerable storage capacities are required at wholesale depots in the main producing areas.

Fertilizer marketing is carried out by different types of enterprises which might be privately owned, co-operatives, or government-controlled. Table 2 shows the participation of these three types in fertilizer retailing in selected countries.

At the wholesale level, the participation of the various types of enterprises is different. In Iran, for instance, the entire wholesale trade is in the hands of the Fertilizer Distribution Company, which is a subsidiary of the government-controlled National Petrochemical Company.

An important difference among the various marketing systems is the degree of vertical and horizontal integration at the wholesale and retail level. An important point concerning the cost of operation and efficiency of the enterprise is the turnover and the integration of fertilizers' sales into the overall business of the retailer or wholesaler. In countries with a rather low level of fertilizer consumption, many retailers handle relatively small quantities of fertilizers with the result of high cost of operation. In many cases, fertilizers have only a

share of five to ten per cent of the overall business of a retailer and the remaining part is in the form of other farm inputs or even the sale of agricultural commodities. Due to the limited demand for fertilizers in many regions and to the subsequent risk involved, many retailers hesitate to enter the fertilizer business at all. In some such cases, government agencies have set up rather expensive fertilizer marketing systems in order to provide fertilizer use.

TABLE 2

PARTICIPATION OF GOVERNMENT, PRIVATE ENTERPRISE AND CO-OPERATIVES IN FERTILIZER RETAILING IN SELECTED COUNTRIES (1971/72)

COUNTRY	PRIVATE	CO-OPERATIVE	GOVERNMENT
		Percentages	
Netherlands	40	60	-
Thailand	85	-	-
Iran	50	5	45
Japan	13	87	-
Nepal	-	-	100
Hungary	-	92	8

SOURCE: FAO/FIAC Fertilizer Case Studies

In countries such as the Netherlands, Japan and Hungary the average annual turnover per wholesaler exceeds 50,000 tons of nutrients, whereas in other countries it is generally below 10,000 tons; at the retail level the average turnover fluctuates between 30 and 700 tons of nutrients. In practice, there are, of course, many individual retailers handling less than 10 tons a year. In the more advanced systems it can be observed that one wholesaler may supply approximately 100 retailers, whereas in other systems, this relation will be only 1.10 to 1.20. It is important to note that in Japan and the Netherlands the co-operative retailers have a higher turnover than the private ones.

In Iran and Nepal, fertilizer retailing is carried out by private enterprise. However, the respective government wholesale enterprises still have a certain control over the retail trade since they appoint and issue licences to fertilizer retailers; also, they generally fix the retail price margins. These examples are important since they illustrate how a government-operated marketing system can be gradually transferred and mixed with operations of the private trade. There might be,

TABLE 3 STRUCTURE OF FERTILIZER SALES OF RETAIL AND WHOLESALE LEVEL IN SELECTED COUNTRIES[a]

COUNTRY	WHOLESALE TRADE				RETAIL TRADE			
	Type	No.	Annual Turnover In Tons[b]	% of Fertilizers In Total Business	Type	No.	Annual Turnover In Tons[b]	% of Fertilizers In Total Business
Netherlands	Private Co-op Federation	5 3	50,000 80,000-100,000	- 15	Private Co-operative	1,200 500	200 720	20-30 10-20
Thailand					Private Wholesalers Retailers	250	240	below 20
Iran	Fertilizer Distribution Company (govt.)	15 Agencies	11,000	100	Licenced Dealers Sales Agents	66 186	600 80-90	- -
Japan	Private Co-op Federation	800 47	2,000 40,000	- -	Private Co-operative	8,500 6,000	30-40 300	50 15
Nepal	Agricultural Marketing Corporation (govt.)	23 Agencies	350	80	Institutional Dealers[c] Private Licenced Dealers	91 190	30	-
Hungary	Agrotröszt (govt.)	17	54,000	43	d			

a *Most of the data refer to the years 1970-72; the indicated types of retailers or wholesalers do not necessarily include all the existing trade.*
b *In tons of nutrients*
c *Co-operatives, village communities, etc.*
d *Most of the fertilizers are shipped directly from the wholesale agencies to the large-scale farms.*

SOURCE: FAO/FIAC Fertilizer Case Studies.

in fact, in many countries the need, especially in the take-off period, for government institutions to takeover most of the marketing operations. However, it is very important to provide for the gradual incorporation of private trade and co-operatives into fertilizer distribution when establishing such a system.

The licencing of fertilizer distributors seems to be useful in this direction, since licenced retailers could be obliged to have a minimum storage capacity, maintain sales records, collect orders in advance and forecast fertilizer needs for the next season. In many other countries, exclusive government-operated fertilizer wholesale and retail agencies have run into heavy losses and have needed subsidies.

EFFICIENCY OF MARKETING OPERATIONS

As already indicated, there are a number of factors strongly influencing costs and efficiency of marketing operations. The most important determinant is probably the volume of fertilizer sales and purchases at the wholesale, retail and farm levels. In countries where fertilizer use is fast becoming widespread, consumption of rather small volumes may be widely scattered over the country. In these cases, considerable efforts are needed to consolidate demand, either through farmers' co-operatives, village communities or other types of farm groups. On the other hand, it is essential that at the retail stage, fertilizers are handled as part of the general trade of agricultural inputs in order to share the administrative overhead costs. It is not generally viable to build up a specialized fertilizer retail system. In those co-operatives which handle fertilizers in Holland and Japan, the fertilizers only have a 10-20 per cent share of the overall business and the average mark-up on the price is 8-9 per cent (which includes storage at the co-operatives).Such a concentrated demand is necessary in order both to obtain price discounts and economies of scale in operations. From Japan it is reported that all the 47 Federations of Agricultural Co-operatives are combined in a National Purchasing Federation (Zenkoren) through which all orders are channelled and which negotiates the price with the fertilizer manufacturers for considerable price reductions. Such vertical integration in purchasing also considerably helps to reduce the costs of handling, since fertilizers are no longer stored and transported at every level. In this way, the function of either the retailer or wholesaler can be limited to collecting orders and administering payments and deliveries.

Transport generally accounts for a rather large part of the marketing cost. In a country such as Iran where the main agricultural production areas are more than 1,000 kilometres distance from the manufacturing plants, average transport costs account for 13 per cent or more of the

final retail price. In many countries where distances vary considerably, transport *costs are often pooled* in order to reach a relatively uniform price for the farmers. Although there are certain justifications for this cost pooling, experience has shown that through this operation, the average transportation cost was considerably increased. The development of fertilizer use in important production areas was thereby obstructed by high prices through which a rather limited fertilizer consumption in marginal and distant areas were subsidized.

In the countries studied, credit sales account for more than half the total fertilizer sales. On the other hand, it can be observed that in some cases the procedures for obtaining credit are rather complicated and *time consuming,* since many forms have to be compiled and various agencies or committees have to approve the request. Some authorities have experimented with establishing a revolving scheme at the village or co-operative level which could be used continuously for the purchase of fertilizers. In regions where fertilizers are used for irrigated lands, water rights can be used as security for the repayment of short-term credits. In many cases fertilizer credit is provided by the same agency which later buys the crop from the farmer, thereby ensuring its repayment. Such an arrangement can be especially suitable in the case of crops destined entirely for industrial processing, such as tea or sugar.

Table 4 indicates the approximate marketing margin for fertilizer in selected countries. The total marketing margin varies from 16-36 per cent. Clearly, a large part of this fluctuation is due to differences in efficiency.*

It is interesting to note that the fluctuation of retail margins is much less. They vary generally between five and eleven per cent.

Fertilizer marketing is a process which requires close co-ordination between production and consumption. This refers especially to countries where most fertilizers are imported. If the market is not sufficiently transparent, considerable costs in storage, handling and capital interest occur at various levels. For an efficient fertilizer marketing system, it is not only important to organize the flow of fertilizers from the factory to the farmer, but to pay equal attention to the organization of demand and to a quick and precise transmission of information and orders from the farmer through the wholesaler and retailer to the fertilizer manufacturer.

* *It is recognized that the relative percentage figures are not completely comparable and only indicate the order of magnitude. It should also be noted that these marketing margins refer generally to a complex fertilizer of the 15-15-15 type and that the final price varies in respective countries from 110 to 130 US $ per ton.*

TABLE 4

MARKETING MARGINS FOR FERTILIZERS IN SELECTED COUNTRIES[a]

ITEM	NETHERLANDS	THAILAND	IRAN	JAPAN	NEPAL	HUNGARY
Average margins (%)						
Importer	-	13	-	-	-	-
Wholesaler	2-4	7-9	-	3	7	15[d]
Retailer	10-12	5	5[c]	9	9-11	-
Sub-retailer	-	3	-	-	-	-
Sub-total	12-16	28-30	-	12	16-18	15
Average transport margin	2	6-8	13	12-15	4-5	7-8
Average total marketing margin	12-18	34-38	18[c]	24-29	20-23	22-23
Percentage of fertilizers purchased with credit (at farm level)	5-10[b]	60-70	-	30-40	-	75[d]

a *The data refer generally to the period from 1970-1972 and the margins are, in most cases, calculated for a compound fertilizer of the 15-15-15 type.*

b *Refers only to sales by CEBECO*

c *This margin does not include the wholesale operations since the costs of the FDC wholesale company are counted as part of the ex-factory price.*

d *Refers only to the Fejer county.*

SOURCE: FAO/FIAC Fertilizer marketing case-studies.

In this connection, it is most important to have a regular forecasting of fertilizer demand for the season ahead and to encourage the farmers and retailers to place orders well in advance. When looking at

the performance of the various marketing systems in the countries analyzed, it appears that the flow of information and timely orders are two of the most important factors in improving efficiency.

GOVERNMENT POLICIES IN FERTILIZER DISTRIBUTION

The assumption which is often made, that private middlemen work inefficiently and should, therefore, be replaced by government distributors or co-operatives is unrealistic and by-passes the real problem. Government institutions have an important role to play in the development process of a good fertilizer marketing system. However, it is most important to discuss the various ways and means by which a government can best promote this development.

In principle, one can distinguish three different types of government action:

a. Provision of facilitating services (price and market information, public warehousing, research, training, etc.) which stimulate and assist business activities;

b. the setting-up of incentives (prices, taxes, subsidies and other regulations) which orient and regulate business activities; and

c. government agencies themselves which partially or totally carry out business activities.

In practice, government policy is usually a mixture of these three possibilities. It is important to emphasize that any type of government policy is not an objective per se but just a way of speeding up economic development. Therefore, government policy should not be a fixed dogma but a flexible strategy. It is useful to keep these general thoughts in mind when the role of the government in fertilizer marketing is analyzed.

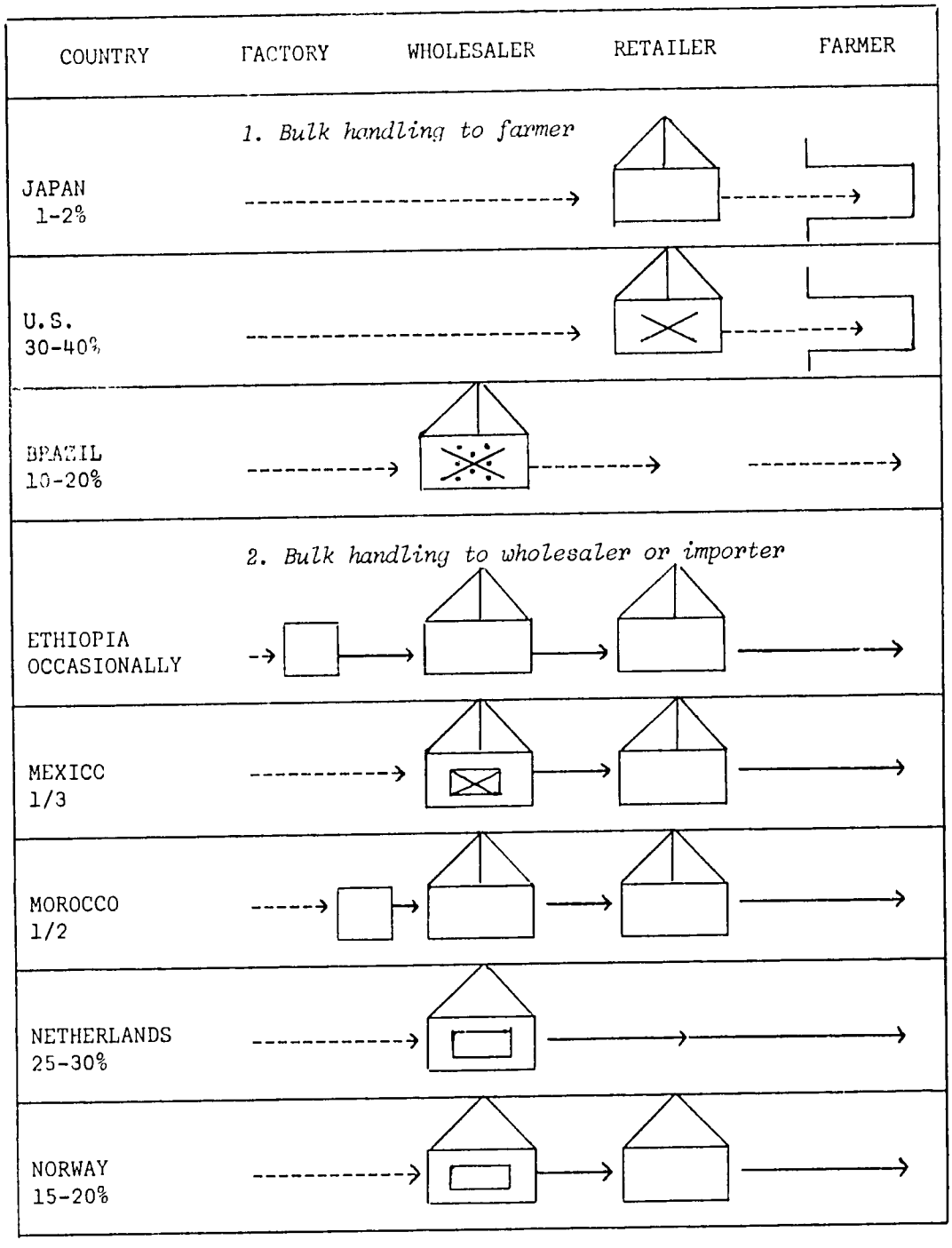
In the six countries analyzed a rather variable form of government intervention can be observed. In all countries, government institutions, usually the Ministry of Agriculture, provides certain services for the promotion of fertilizer use. The extension services organize fertilizer demonstrations and trials, sometimes assisting in the assessment of fertilizer demand and advising farmers on the types and correct use of fertilizers. Although this service exists in all countries, there is no doubt that there are great differences in the impact and the effectiveness of the services provided by the individual extension agencies. It can also be observed that in many cases there is little co-ordination between the extension services and the actual fertilizer distributors,

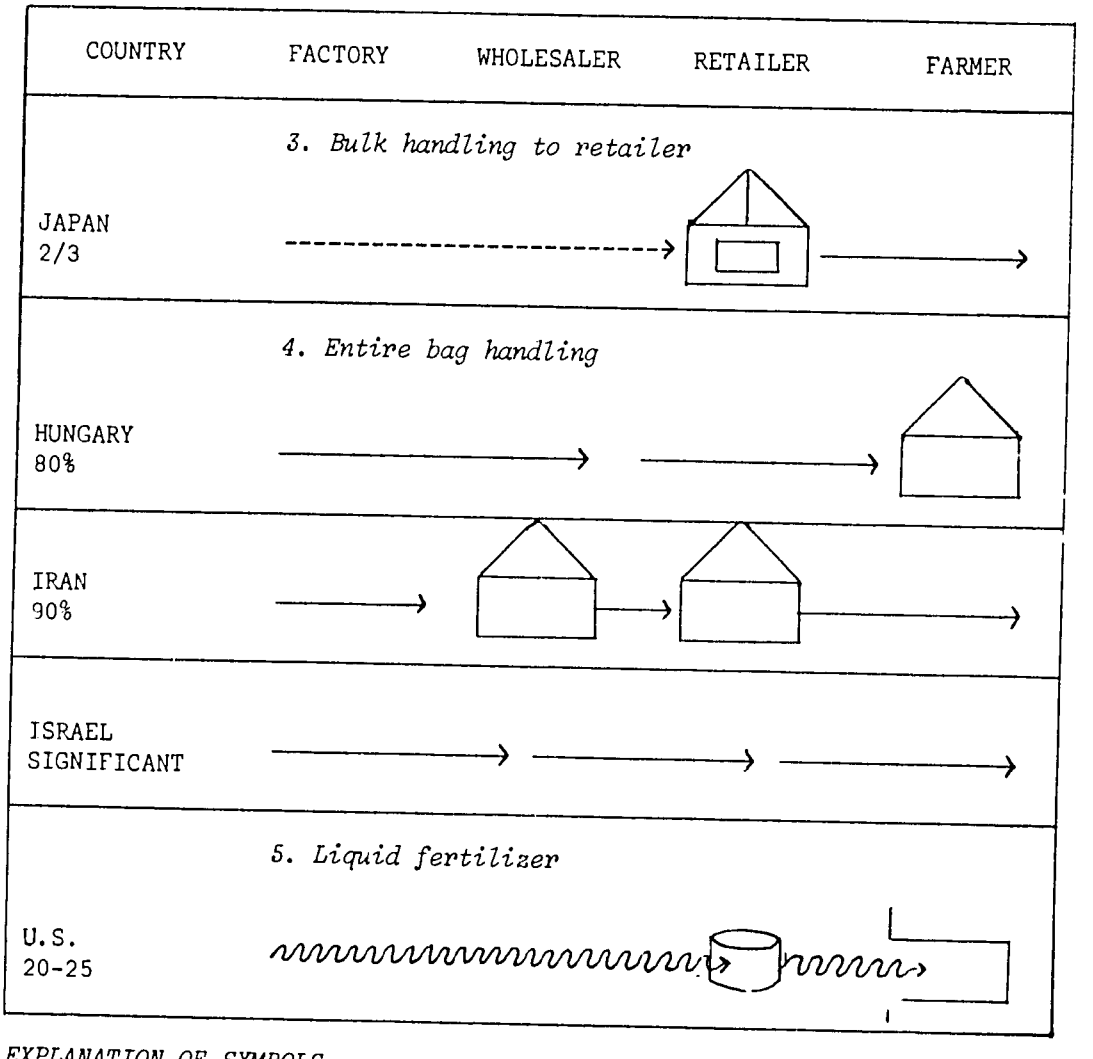
thus reducing the effectiveness of the technical advice. In countries such as the Netherlands where the large fertilizer distributors, especially the co-operative associations, have built up their own extension service, it is probable that the technical advice is more effectively used in practice.

In four of the six countries referred to, there is some kind of control or influence on fertilizer prices and margins. In a country such as Hungary, the government intervention in fertilizer marketing is in conformity with the overall economic system. In other countries, such as Nepal and Iran, government intervention is based on the assumption that private trade is unable at the present stage of development to carry out the necessary wholesale or retail functions. In many cases, especially during the initial period, there is no commercial infrastructure for fertilizer distribution. During this phase, a good deal of promotional services are required for rather limited sales volumes and, for this reason, private retail and wholesale enterprises often hesitate to enter this business. If government agencies themselves distribute the fertilizers, it is very important that they apply commercial criteria to their operations as far as possible and carefully endeavour to identify any elements of subsidy. Mechanisms may be built into these government operations which permit the gradual involvement of private enterprise into the fertilizer business.

The establishment of fixed wholesale and retail margins is often defended by the argument that extreme price fluctuations and excessive profits of private traders have to be avoided. However, careful attention should be paid to making these margins flexible enough to enable them to adjust realistically to costs. Consideration should also be given in the initial stages to the need for margins which allow private enterprises to make additional investments in storage and transport facilities. In many cases, it is more effective to promote increasing competition among private traders than to fix the margins. A case in point is the Netherlands where, without any government regulations, retail and wholesale margins are kept at a moderate level due to the intensive competition among private traders and co-operatives.

DIFFERENT HANDLING SYSTEMS FOR FERTILIZERS IN SELECTED COUNTRIES





EXPLANATION OF SYMBOLS

Bagged fertilizers ——→

Bulk fertilizer - - - - - →

Liquid fertilizers ∿∿∿→

Bagging ▭

Blending ×

Granulating ⁘

Storage ⌂

Fertilizer application at farm done by retailer ⊔

The figures below the countries indicate the approximate share of the respective system in the total fertilizer supply.

In all cases, fertilizer factories have a certain storage function which is not included in this graph.

If the arrow is interrupted, it means that the wholesaler or retailer is involved in the marketing transactions; however, if no further symbol is indicated, he does not physically handle the fertilizers.

Mr. Wierer is a Marketing Economist at the Marketing and Credit Service, F.O.A., Rome.

The Philosophy and Role of Marketing Development in Increasing Fertilizer Use in Pakistan

Mr. Syed Abu Khalid

Many people in Pakistan today believe fertilizer can be "marketed without any promotion or organization". Such ideas have largely developed due to a tight supply situation, which has been prevalent in the last couple of years when demand exceeded availability and people were prepared to pay any price to give their crops the benefit of fertilizers. If it is a question of distribution of shortages, certainly no organization or development effort is required. In this paper I am assuming a balanced supply and demand situation for all types of fertilizers; I am also assuming that supplies will be available to meet the increasing demand in future years.

The subject of market development for fertilizer is immensely more intricate and complex in its character than generally understood. It encompasses a whole range of sociological, psychological and economic factors in our rural environment. To achieve a desired level of fertilizer consumption, favourable conditions have to be created to give due recognition to the role of fertilizer in optimizing farm outputs and profits. The approach and effectiveness of any market development activity bears directly on creating such an environment.

WHY PROMOTE FERTILIZER USE?

The 'Green Revolution' of the late sixties raised Pakistan's agricultural production at an unprecedented rate and brought the country close to self-sufficiency in food. New high-yielding varieties of wheat and rice crops quickly multiplied to cover large areas. The production of wheat jumped from 4.52 M tons in 1964/1965 to 7.18 M tons in the year 1969/1970 (Table 1). But in the following two years, the trend was not maintained.

The goal of self-sufficiency kept eluding us from year to year. Today, as never before, the challenge is far greater to achieve increased farm productivity since our population was estimated to be increasing at an annual rate of 3.2 per cent during 1961/1972. At this rate it is expected to double itself before the turn of the century. The challenge is to increase farm productivity so that self-sufficiency in food eludes us no more; to produce enough to feed the entire nation and create surpluses to generate capital formation at the farm level: in short, to create a viable agricultural economy.

The agricultural productivity of our country is one of the lowest in the world. The history of many developing countries and the realities of our own situation indicate that improvement in agricultural production will have to come from increasing our present crop yields and not necessarily from expanding the total cultivable area. The resources required to bring an additional acre into cultivation are far greater than to increase the yields from an already cultivated acre. Pakistan has a tremendous scope for improvement in this respect as indicated by the gap in the average yields of crops obtained in Pakistan compared to some of the agriculturally well-developed countries of the world (Table 2). The gap can be narrowed, if not completely filled. This is indicated by the difference in yields obtained from supervised demonstration plots with improved agronomic practices and the yields under common farmer's conditions (Table 3).

TABLE 3

AVERAGE CROPWISE YIELDS IN IRRIGATED AREAS OF PAKISTAN - EPFCL DEMONSTRATIONS VS AVERAGE FARMER

CROP	EPFCL's DEMONSTRATIONS (Lbs./Acre)	AVERAGE FARMERS (Lbs./Acre)
Wheat	4,130	1,200
Cotton (Seed Cotton)	2,139	900
Sugar-cane	83,800	35,000
Rice	5,496	1,500

FACTORS AFFECTING CROP YIELDS

There are many well-known factors which contribute to increased crop productivity. However, the factor that has contributed most to increasing crop yields in different countries as well as in Pakistan is the 'bio-hydro-chemical' factor or the seed - water - fertilizer factor. These elements are certainly not listed here in order of merit or precedence. It is really a combination of these factors and their synergistic effect that goes to produce higher yields.

Besides the 'bio-hydro-chemical' factor, there are a host of other factors such as management practices, pesticides, mechanization, farm tenure and size, etc., that affect the farm productivity. But given a constant condition in regard to these multifarious factors, the 'bio-hydro-chemical' factor has proved to be the most critically limiting. First, I would like to discuss seed and water and their relationship with fertilizer and finally fertilizer itself.

HIGH FERTILIZER RESPONDING VARIETIES

As you are aware, high fertilizer responding varieties (HFRV) of wheat and rice were introduced in Pakistan in 1966 and 1967 respectively through an organized effort of the Ford Foundation and the agricultural department. These 'miracle' varieties quickly caught the imagination of the farming community in a way that has rarely be excelled in any other country of the world. In a short period of three years, high yielding wheat occupied over 60 per cent of the wheat area in the irrigated belt of the Indus basin. Today, this wheat is grown on more than 3/4 of the total irrigated wheat acreage. Irri rice, which was introduced in 1967, is now occupying more than half the total rice acreage. But the quick multiplication of the acreage under these varieties did not multiply the yield in the same proportion. As the area under these varieties spread quickly, their inherent potential was not fully exploited because the common farmer got the impression that all one has to do is to shift to the new variety and achieve instant success. This, of course, was far from true. It was soon seen that the 'miracle' could only be realized with improvement in other aspects of crop husbandry. This was particularly true of adequate fertilization. The new varieties have been bred to respond to a high rate of fertilizer application without which they are only marginally better than the traditional varieties.

After the introduction of high fertilizer responding varieties of wheat in 1966/1967, the per acre yield quickly jumped and registered an average of 12.1 maunds* in 1969/1970 (Table 1) which has remained at that level. Rice yields rose from 8.97 maunds per acre in 1959/1960 to 16.1 in 1969/1970 and Pakistan was able to export considerable quantities in a year of worldwide shortage of the food grain.

Cotton is the most important foreign exchange earning crop. It has also shown a steady progress in per acre yield which has risen from 1.64 maunds per acre in 1959/1960 to 4 maunds in 1971/1972. A sudden spurt in the size of the crop from 3 million to 4 million bales from 1970/1971 to 1971/1972 came through a rise in yield from 3.4 maunds an acre to 4, allied to changes in pricing policy encouraging farmers to apply increased quantities of fertilizers. In the last seven years, the per acre use of nitrogen on cotton has gone up from 10 lbs. per acre to 25 lbs. per acre (Table 4).

Nevertheless, cotton production is still poor by world standards. The causes of low cotton yields are considered to be inefficient planting techniques and low seed rates with poor germination resulting in only 8-10,000 plants per acre instead of 20-25,000. This problem is further aggravated by the low application of fertilizers and insufficient plant protection measures. Not long ago, it was generally thought that the cotton varieties grown in the country would not respond to fertilizer application and, as such, the farmers shied away from using fertilizers. The experience of the last few years has clearly demonstrated that it was not quite true and even the existing varieties were capable of giving increased output with judicious use of fertilizers and pesticides. Cotton yields have closely followed the pattern of increased fertilizer use on the crop. The remarkable progress of 1971/1972 was not repeated in 1972/1973 and production actually fell slightly, to 3.95 million bales, largely because of low availability of fertilizer during Kharif of 1972.

Although the present varieties of the major crops need a great deal of genetic improvement to maximize yields, low yields can be improved to a great extent with the application of recommended doses of fertilizers (Table 5).

WATER

Pakistan is an arid/semi-arid area with insufficient rainfall to

* *an Asian measure of weight of varying value - usually 1 maund = $82^2/7$ pounds.*

sustain profitable agriculture. Therefore, the availability of irrigation water becomes a prerequisite for carrying out crop production activity. Water is expected to be a scarce input even with the developments envisaged. According to the Water and Power Development Authority (WAPDA), the projected ultimate water balance available for farm use in the Indus plains in an average year will be about 82 million acre ft. of water, about 5 million acre ft. short of the total requirement. Adequate irrigation water alone cannot increase yields. It is the use of fertilizers in the presence of irrigation facilities that can help to maximize crop yields, thus multiplying irrigation efficiency. Much of our irrigation water is wasted because of poor field layout, unlined water channels and injudicious use. Better water management can reduce the national water deficit very considerably.

FERTILIZERS

Use of fertilizers is directly associated with the inherent fertility level of soils. Pakistan soils are, generally speaking, low in organic matter. Additional nitrogen is needed to support profitable crop husbandry. Research on farmers' fields has indicated that crops respond to nitrogen on 90 per cent of soils. The phosphorus content of the soils is comparatively better. This nutrient is required on more than 50 per cent of the soils for achieving good crop yields. Potash is required on about 10 per cent of the areas.

Fertilizer trials conducted on major crops in the country clearly indicate that high yielding wheat and rice varieties, and cotton and sugar-cane crops respond very favourably to fertilizer application and doubling or even tripling of yields is possible with very favourable input/output ratios. The research results also indicate that not only fertilizer application is essential for obtaining high yields, its balanced use is equally essential. The lack of one nutrient cannot be compensated by the excess of the other. Positive interactions between NP and NPK have been achieved on all crops under different soils and climatic conditions.

By now the major role fertilizers must play in increasing agricultural productivity is quite apparent. The importance of fertilizer use cannot be over-emphasized and it is almost axiomatic to say that without fertilizer use, one-fifth of the world population would face prospects of starvation. This would be equally true for Pakistan.

GROWTH IN FERTILIZER CONSUMPTION

The use of fertilizers by the Pakistan farmer is a relatively new phenomenon. From practically no consumption of fertilizer in the fifties, it reached around 100,000 nutrient tons by 1965 (Table 6). A comparatively slow growth was witnessed up to the year 1968 when a real breakthrough was achieved and in the last five years the growth in consumption has been steep. It is estimated that 600,000 nutrient tons will be consumed in the current fiscal year 1973/1974 (also see Diagram 1). By now it is well-known that the introduction of high fertilizer responding varieties (HFRV) of dwarf wheat in 1966 and Irri rice in 1967 gave a spurt to fertilizer consumption.

Points often missed are: (a) the concerted efforts made by Government Extension and Research Agencies and (b) the contribution of the private sector, which was inducted into fertilizer marketing concurrent to the introduction of high yielding varieties. The private sector brought a new dimension, too, and created new scope in fertilizer marketing.

As a result of the above factors, the growth in fertilizer consumption has been impressive, as the consumption jumped from 7.7 lbs. per acre to 32.7 lbs. per acre within a period of seven years. However, this level of consumption is well below the 'ideal' for the achievement of national goals and objectives of self-sufficiency in food and other agricultural produce. The per acre consumption particularly by cotton, rice and sugar-cane needs considerable improvement (Table 5).

MARKET DEVELOPMENT - The Role

Increased fertilizer consumption can be achieved through concerted market development efforts. The roles that market development must play are:

1. To bring about a revolution in the attitude of the farming community in accepting the role of fertilizers and other farm inputs to increase crop productivity. Many of our farmers have the right attitude as amply demonstrated in the acceptance of the 'new seeds' introduced back in 1966/1967. Sufficient awareness regarding the use of fertilizer has also been demonstrated, although growth has been slow. The easy advances of the early stage of development are coming to an end. Any further substantial increase has to be brought about with changed

market development strategies followed with fresh and vigorous efforts. A conviction regarding the economic benefits of fertilizer use and a need for increased agricultural productivity have to be created. It is often erroneously thought that by making fertilizer available in plenty, it will be used by all in desired quantities and proportions. This we do not think is an accurate appraisal of the situation.

2. To promote a balanced use of various types of fertilizers to maximize crop productivity.

   It is not only total fertilizer consumption, which is important, but the balanced use of NPK is equally important and sometimes even more important. Keeping in view Pakistan soils and crop responses to fertilizer application, the ratio of nitrogen to phosphate use should be narrowed down to about 3.1 for best results. Use of phosphates has so far lagged behind. The current ratio of NP use is estimated to be about 8.1. Agronomic research has shown that wherever phosphate is a limiting factor, which is so in more than 50 per cent of our soils, the application of nitrogen alone will not optimize crop productivity. The gap between nitrogen and phosphate use will have to be filled if Pakistan's agriculture is to achieve a breakthrough. The full utilization of the existing organizations and their channels of distribution, whether in public or private sector, is necessary to fill the gap in phosphate use.

3. To advise on and demonstrate to the farmers, the modern methods of crop production and effective methods of fertilizer use.

   It has been said earlier that higher yields are commonly obtained under supervised demonstration schemes compared to the farmer's yields with his own practices and this has been possible strictly under farmers' own conditions without significantly altering the resources of the farm. It is really the application of some simple and easily teachable innovations that helps to boost yields. The efficiency of any input can be significantly reduced if it is not used at the right time or in the right manner, particularly when the input being used is scarce.

4. To increase in depth use of fertilizers.

   It is generally seen that our farmers have a tendency to apply the total available fertilizer, whatever that may be, to the

entire crop acreage cultivated by them. This sometimes means spreading the only bag of fertilizer on two or even three acres. This will have practically no effect on crop yields. If better results are to be achieved, the farmers will have to be taught that it is better to use the one bag of fertilizer available with him on half an acre or one acre, as recommended, and maximize his yield from that unit of area rather than spread the quantities on the total acreage and reduce the effectiveness to nothing. Phosphate and potash particularly if applied in small amounts get fixed in the soil and their availability to plants is almost nil.

5. To create an economic sensitivity in farmers' minds.

It should be brought home to the farmers that the use of inputs means increased income to them. This is regarded as the strongest stimulus for accepting any innovation. In the final analysis, one of the more important objectives in the use of fertilizer or any other input is to increase farmers' profitability.

6. Effective utilization of resources.

Our agriculture suffers from a limitation of resources. While the Government is making efforts to increase the availability of credit, seeds, fertilizers, water and pesticides, the extension should aim at educating the farmers to adopt techniques that will help them to conserve the resources and increase their efficiency.

In West Pakistan, where irrigation water and the farmers' resources of purchasing fertilizers are limited, it is extremely necessary that the quantities available are used at the right time and in the right manner. A very typical example is the application of irrigation water in excess of the crop water requirement. Similarly, using nitrogen on rice after panicle initiation or on cotton after boll formation or top dressing the wheat with phosphates serve no beneficial purpose. Therefore, in spite of the limitation of inputs, crop yields can be improved by utilization of the available resources.

The roles of market development described above, can only be achieved through concerted efforts with the help of a well co-ordinated scheme, which we term as Integrated Market Development. It must be pointed out here that the features of the approach to market development

which I propose to present in the following paragraphs, have been practised in the country though in a disjointed manner. Therefore, in isolation and individually the extension techniques are well-known to people. In the previous approaches, what really happened, was that the tools of extension such as demonstrations or farmers' meetings have been regarded as an end in itself, whereas in actual fact these are only means to an end.

THE APPROACH

Our approach is one of a 'package deal' or 'integrated development' to bring about the desired results. A brief resume of the approach follows:

1. *Establishing an extensive dealer network* so that fertilizer is available to the farmers when and where needed. This requires the development and organization of a dealer network closely supervised by a professional selling force. The success of the system will largely depend upon the type of dealers selected to run the fertilizer outlets.

   The selected dealers should be trained to keep them motivated and abreast of modern merchandizing techniques. They should also be given sufficient background of plant nutrition, soil fertility, modern crop production methods, input requirements for profitable agriculture, etc.

   The dealer should be supervised by a team of aggressive professional sales personnel who should be responsible not only for obtaining orders from the dealers but also for assisting them in moving the product to the farmers through scientific methods of soil testing, and farm calls. The sales force should also assist them in developing sales forecasts, maintaining records, arranging for visits of technical personnel, conducting farmer meetings, laying farm demonstrations, organizing field days, etc. The sales personnel should also ensure that the dealers do not indulge in unwholesome practices. The sales force should, in turn, be kept motivated by sound personnel management practices.

2. *Agronomic Research*

   The advisory service of the extension workers should be fully backed by sound research results. Accurate information on the

responses of various crops to fertilizer application must be available. A continuous research effort is required so that the farmers are advised of new research results. This creative research should be geared to the farmers.

3. *Soil Testing*

Only fertilizer recommendations that will bring maximum profits should be made to the farmers. Soil testing is probably one of the most effective tools available in promoting sound fertilizer use. This is particularly true for promoting such nutrients as phosphates and potash, which are not required universally. A chain of commercial soil testing laboratories should be established in the agricultural areas. Mass media can promote the facilities. It is recommended that before such commercial laboratories are established, a soil fertility map should be drawn with the help and co-operation of international agencies. Such a map would provide a ready reference to the extension workers for making fertilizer recommendations.

4. *Crop Demonstrations*

Many farmers are reluctant to use fertilizer or to use sufficient amounts because most often they do not know the benefits. The demonstration programme helps to illustrate the effect of fertilizers and other techniques. Demonstrations should be planned and designed on the basis of accurate soil test results so that the effect of different treatments can be accurately predicted.

5. *Field Days*

Field days should be conducted on all successful demonstration plots when there is a visible proof that the demonstration is a success. Field days enable the extension workers to reach many more farmers. For best results, two or more field days at different stages of crop growth should be organized: i.e. just before harvesting time when the crop is showing clear and visible difference in responses to various fertilizer applications and again at the time of harvesting when the crop can actually be weighed and the difference in yields from various treatments can be actually measured.

6. *Farmers and Dealers Meetings*

Farmer meetings are one of the most effective means to taking the information to the doorsteps of the farmers. Such mass

contact with the farmers for advising them about crop production programmes is vital for disseminating agronomic information. Farmers' meetings should be organized in the villages. Uses of modern audio/visual aids such as charts, slides, films, etc., should be used. Farmers should be encouraged to bring out their problems for discussion by the entire group. The economics of fertilizer use and use of other inputs should be specially highlighted. To get best results the meeting should be based on a prepared script.

7. *Farm Visits and Group Discussions*

Farmers' meetings usually result in requests from farmers for visits to their farm to look into specific problems which usually cannot be solved in group meetings. This is also often used for collecting soil samples to give more specific recommendations for fertilizer use. Group discussions are used for farmers who are reluctant to attend farmers' meetings. A smaller number of farmers in small groups are handled in the same manner as in the farmers' meetings.

8. *Integrated Market Development Approach*

The agronomic research and the market development activities outlined above do not take place haphazardly but follow a planned, co-ordinated and logical cycle. For illustration purposes, the sequence of events for wheat is presented below:

MONTH	STAGE	ACTIVITIES
July-August	Planning	Evaluation of data from previous season's trials, preparation for next season. Preparation of scripts, slides, and other presentation materials and literature for distribution.
September-October	Pre-planting	Farmer meeting, farm visits, group discussions and soil testing.
November-December	Planting	Planting experiments and demonstrations, follow-up calls.
January-February	Growing	Maintenance of experiments and demonstrations, follow-up calls.
March-April	Ripening	Field days.
May-June	Harvesting	Field days, harvesting, collection of data.
July-August	Planning	Evaluation of data and collection of testimonials.

The cycle is then repeated. Similar cycles are followed for all major crops.

In a country like Pakistan which is characterized by an acute illiteracy problem, inadequacy of means of communication, its aggregate unsophistication, resource constraints and hordes of other factors intimately related with its underdeveloped agriculture, a real breakthrough in agriculture can only be achieved with the help of a massive drive to bring about a positive change in the attitude of our people.

The future can be promising. The vast potential of our agriculture still remains unrealized. But as the development takes place, our people must be prepared psychologically and physically to accept responsibilities that will come in the wake of development.

In the end, before concluding, I would like to point out that the market development approach outlined in the paper has been successfully operated by Esso Pakistan Fertilizer Company Limited with commendable results.

Mr. Khalid is Marketing Manager at Dawood Hercules Chemicals Limited, Lahore.

TABLE 1

OUTPUT AND YIELD OF MAJOR CROPS

	1959/1960	1964/1965	1969/1970	1970/1971	1971/1972	1972/1973
		Output	(Million Tons)			
Wheat	3.85	4.52	7.18	6.37	6.78	7.32
Rice	0.98	1.33	2.38	2.17	2.22	2.30
Sugarcane	10.49	18.37	25.95	22.80	19.69	19.60
Cotton (million bales)	1.64	2.12	3.02	3.05	4.10	3.95
			Yield (Maunds per acre)			
Wheat	8.68	9.36	12.1	11.7	12.1	13.4*
Rice	8.97	11.03	16.1	15.9	16.8	16.1*
Sugarcane (stripped)	291.48	403.33	461.1	394.9	391.9	370.6*
Cotton (lint)	2.34	2.81	3.3	3.4	4.0	3.7*

* *Calculated from production given in this table and area given in Statistical Bulletin June '73.*

TABLE 2

COMPARATIVE FIGURES OF CROPS SHOWING PER ACRE YIELD OF PAKISTAN ALONG WITH SOME OTHER COUNTRIES OF THE WORLD

COUNTRY	WHEAT (1964/65-67/68) (Lbs./A)	COTTON (1967) (Lint Lbs./A)	RICE (1968) (Lbs./A)	SUGARCANE (62/63) (Mds./A)	MAIZE (Lbs./A)
Argentina	1,265	-	-	904	-
Australia	1,045	-	-	786	-
Barbados	-	-	-	703	-
Canada	1,357	-	-	-	-
China	913	-	-	-	-
Cuba	-	-	-	454	-
France	2,864	-	-	-	-
Hawaii	-	-	-	2,036	-
India	733	-	-	-	-
Italy	1,958	-	4,692	-	2,899
Japan	-	-	5,096	-	-
Mexico	-	618	-	-	-
Peru	-	-	2,732	1,538	-
Puerto Rico	-	-	-	1,586	-
Portugal	-	-	4,134	-	-
Republic of Korea	-	-	3,486	-	-
Spain	-	-	5,703	-	-
South Africa	-	-	-	999	-
Syria	-	497	-	-	-
Taiwan	-	-	3,490	681	-
Turkey	1,019	479	-	-	-
UAR	-	513	4,142	-	-
USA	1,566	480	4,476	561	1,566
USSR	1,010	729	-	-	-
Pakistan	726	255	1,472	347	920

TABLE 3

AVERAGE CROPWISE YIELDS IN IRRIGATED AREAS OF PAKISTAN - EPFCL DEMONSTRATIONS VS AVERAGE FARMER

CROP	EPFCL'S DEMONSTRATIONS (Lbs./Acre)	AVERAGE FARMERS (Lbs./Acre)
Wheat	4,13[illegible]	1,290
Cotton (Seed Cotton)	2,133	600
Sugar-cane	83,800	35,000
Rice	5,496	1,500

TABLE 4

PER ACRE NP CONSUMPTION BY MAJOR CROPS IN 1966 THROUGH 1973
NUTRIENTS (LBS./A)

YEAR	WHEAT				RICE				COTTON		SUGARCANE		AV/ACRE OF IRRIGATED AREA	
	Local		Mexi		Local		Irri							
	N	P_2O_5	N	P_2O_5	N	P_2O_5	N	P_2O_5	N	P_2O_5	N	P_2O_5	N	P_2O_5
1966	8.0	-	-	-	5.0	0.2	-	-	10.0	0.2	24.6	0.6	7.7	0.2
1967	8.0	-	35.0	1.7	6.0	0.3	-	-	12.0	0.5	29.4	1.7	9.2	0.6
1968	8.0	-	35.5	3.0	6.0	0.6	25.0	2.8	19.3	0.8	47.4	3.0	14.8	1.8
1969	10.0	-	35.5	4.5	7.0	1.6	23.5	4.5	22.5	1.6	50.2	4.5	18.8	3.4
1970	7.0	-	28.0	2.7	5.0	0.7	14.0	3.0	20.0	0.7	40.0	3.2	15.9	1.5
1971	9.0	-	32.0	3.0	6.0	1.3	18.0	3.5	20.5	1.0	42.0	3.0	20.0	2.8
1972	9.0	1.0	40.0	4.5	5.0	1.5	15.3	4.0	17.5	1.5	50.0	4.0	24.8	3.6
1973	9.0	1.5	45.0	5.0	6.0	1.7	27.0	4.5	25.0	1.7	60.0	5.0	32.7	4.2

TABLE 5

WEST PAKISTAN
AVERAGE VS RECOMMENDED FERTILIZER USE

1971

Lbs./Acre (Nutrients)

CROP		AVERAGE			RECOMMENDED		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O
Wheat	- Mexipak	32.0	3.0	-	130	75	-
	- Local	9.0	-	-	50	50	-
Rice	- Irri	18.0	3.5	-	125	75	-
	- Local	6.0	1.3	-	60	50	-
Cotton		20.5	1.0	-	75	50	-
Sugarcane		42.0	3.0	-	175	75	75
Maize		12.0	1.0	-	125	75	50
Oilseeds		5.0	0.8	-	70	65	-
Others		5.0	0.5	-	37	50	-

TABLE 6

FERTILIZER CONSUMPTION DATA 1961-1973

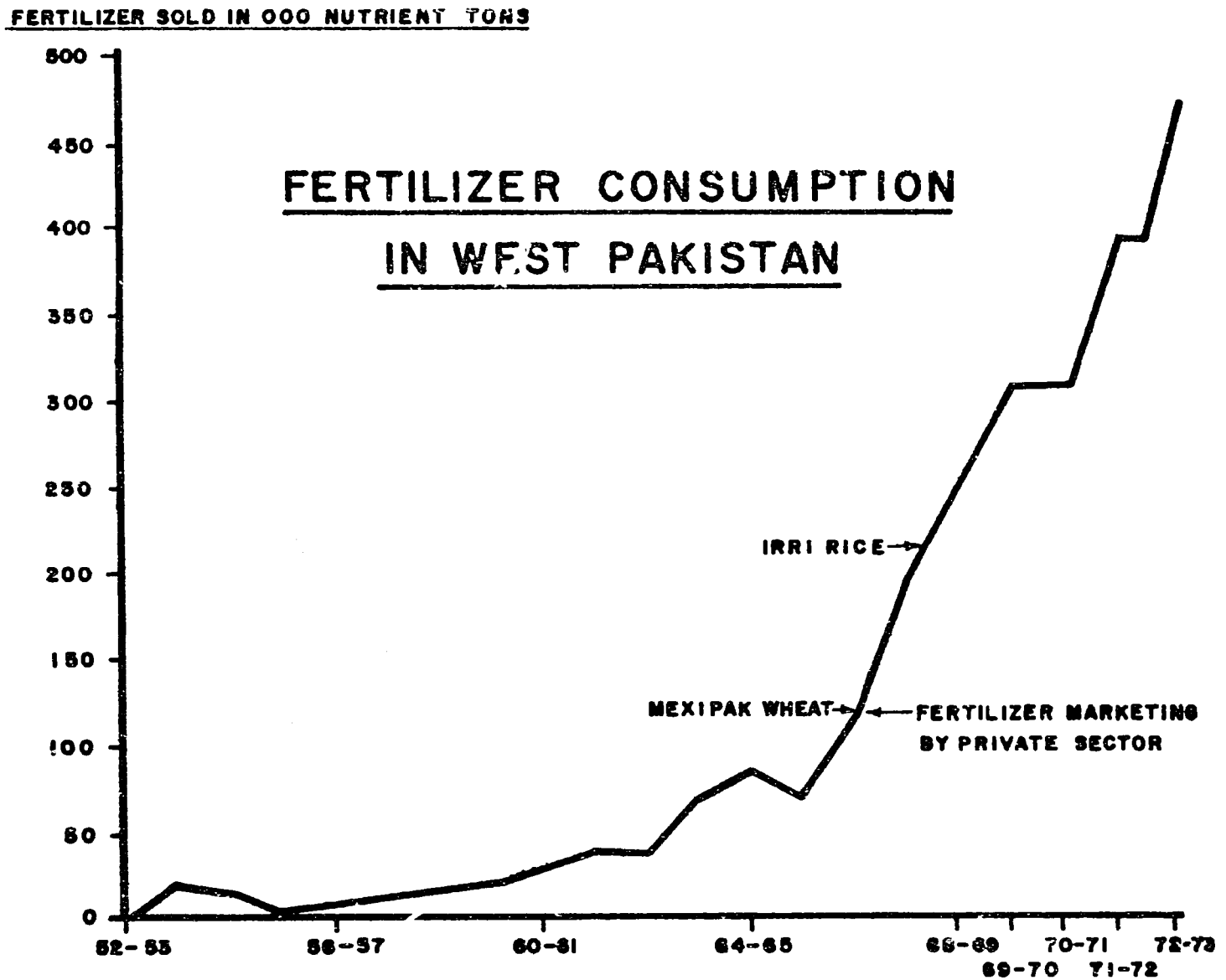
(000 M Tons of Nutrients)

YEAR	N	P_2O_5	K_2O
1961	34.0	0.4	-
1962	38.5	0.4	-
1963	54.0	0.5	-
1964	76.5	1.5	-
1965	77.0	1.7	-
1966	106.6	2.8	-
1967	127.3	7.7	-
1968	204.5	24.5	-
1969	258.7	47.0	0.5*
1970	219.5	21.3	1 *
1971	275.0	38.2	1 *
1972	341.0	50.0*	1 *
1973	450.0*	58.1*	2 *

* *Estimated figures*

SOURCE OF DATA: 1. *Report of CENTO Adhoc Working Party on Fertilizers 1968*

2. *EPFCL Reports*


FERTILIZER SOLD IN 000 NUTRIENT TONS
FERTILIZER CONSUMPTION
IN WEST PAKISTAN
500
450
400
350
300
250
200
150
100
50
0
IRRI RICE
MEXIPAK WHEAT
FERTILIZER MARKETING
BY PRIVATE SECTOR
52-55
56-57
60-61
64-65
68-69
69-70
70-71
71-72
72-73

V. The Logistics of Fertilizer Use

Farmers and Fertilizers
(Meeting the Farmers' Needs)

Dr. A. Rahim Chaudhry

You have heard the views of the scientists, the manufacturers and the distributors. I have been asked to present the subject from a farmers view point.

The discovery of fertilizers was not an abrupt finding by a scientist in the laboratory or a careful cultivator in the fields. For centuries, the near invisible accumulation of knowledge about the hunger signs of plants and the advancements of chemistry neglected the possibilities of man-made nourishment for plant life. Those who knew something of both sides, might have tried to translate the laboratory knowledge of artificial food for crop improvement to practical methods in the field.

The earliest known fertilizing was "shifting cultivation". The land was allowed to lie uncultivated for one season or more to enable it to restore its vigour through natural agencies. The introduction of modern cropping schemes and patterns are an improved variation of this very primitive concept.

Chinese agricultural records reveal that the farmers maintained soil fertility in certain areas by returning a maximum amount of plant, animal and human waste to the land for over forty centuries.

The modern agricultural science of mechanical production of plant nutrients is not more than two hundred years old. The first notable work on fertilizers was started in 1775 when the Edinburgh Society For The Improvement of Arts and Manufacturing asked Frances Home to investigate the possibilities of using chemistry in agriculture.

The two famous chemists, Humphrey Davy of England and Von Thaer of Germany, collected farmers' knowledge of fertilizing and tried to translate this knowledge into chemical terms. Then physiologists began investigating what substances the plants require as food and chemists investigated the manurial requirements of vegetable life.

The two groups contributed a lot in their respective fields of research, but no abstract principles were adopted concerning plant nutrition. The most authentic and brilliant suggestion came from the German chemist, Liebig, in 1840. He contended, on the basis of botanical research that farmers could increase their crop yield by adding the necessary mineral matter to the soil in the form of salts. It took a considerable period of time to convince people of the real worth of artificial fertilizers.

In the middle of the nineteenth century it was discovered that nitrogeneous fertilizers could be manufactured from the air. Sir William Crookes mentioned that in his famous address to the British Association. Norway was the first to manufacture fertilizers from the air. The production of artificial fertilizers increased steadily and, according to estimates, consumption stood at 50.4 million tons by the middle of the twentieth century.

Systematic work on crop improvement was begun in the Indo-Pakistan subcontinent by the end of the nineteenth century. In 1890, an English scientist was invited to study the problems of crop improvement. He published a book on Indian agriculture in 1893, and based on his recommendation, an agricultural chemist was appointed in 1901.

The preliminary results of the resultant researches were published in The Geophysical Geography of India in 1904 and some abstracts were also published in the journal "Mofeed-ul-Muzareen" in the intervening period. Some experiments on phosphates were made in the area where we are holding this seminar today and it was proved that application of phosphates was very useful indeed but as wheat was selling at one rupee a maund (82 lbs.) and phosphatic fertilizer was selling at Rs. 5/- per bag, it was considered as uneconomical.

Until the mid-twentieth century, farmyard manure was considered the main source of plant nutrients in the Indo-Pakistan subcontinent. This was, however, not available in ample quantities. According to an estimate made during the 1940's, one pair of bullock could produce nearly 3 tons of farmyard manure. It was estimated that if all the dung was used as fertilizer, it could produce almost 134,819 tons of nitrogen in the province of Punjab leaving a deficit of 129,634 tons to be supplemented by other measures.

This induced the government to resort to the use of artificial fertilizers. The extension staff worked hand-in-hand with farmers and the use of fertilizer in the country increased gradually. By 1955 the consumption was 35,000 tons.

The government decided to establish its first factory at Daudkhel in 1956. This factory was supplemented by three more factories in the public sector. These were located at Multan, Lyallpur and Jaranwala. The factory in Multan was based on natural gas and started manufacturing urea and ammonium nitrate, while the two small factories started producing single superphosphate. The total consumption of fertilizer then increased considerably.

It was at this point that the private sector was encouraged to build fertilizer plants. Esso Fertilizer (Pakistan) was the first in 1968. Subsequently another factory was established near Lahore by Dawood Hercules Limited in October, 1971. By 1970-71, Pakistan was producing a total of about half a million tons. Even this was insufficient to meet the demand and supplementary imports were necessary. The imports increased from 10,000 tons in 1952 to almost one million tons in 1969-70.

All this indicates that the farmers in this country are responsive. I cannot agree with those who say that the farmers of this country are lethargic and do not respond to better means of production. They have, however, their own difficulties.

We have a long way to go. The per acre consumption is still very, very low. In the year 1968-69 our consumption was barely 12 lbs. per acre as compared to 556 in Netherlands, 301 in West Germany, 361 in Japan and 270 in China.

To further increase our consumption, vigorous efforts are necessary in the public and private sectors. Some of the impediments in those efforts can be summarized as follows:

(a) Ever-increasing costs;

(b) inadequate supporting services;

(c) conflicting crop requirements;

(d) irrational marketing systems; and

(e) inadequate financial support.

INCREASING COSTS

The sale price of fertilizers has been increasing very rapidly and revisions are also quite frequent. To cite an example, fertilizer prices have been raised three times in the last year with an overall increase of 100%. The cost of other inputs has also increased tremendously. Such measures upset the farmers and offset their planning a good deal. The net result is that the farmers are compelled to use less fertilizer and also to keep their farm budgeting proportionately in fact.

Such prices would normally be fixed for longer periods - say 3 to 5 years. Any fluctuations during this period should be absorbed by the government by re-adjustments in subsidies so that the farmers could look ahead and plan accordingly with confidence.

Planning at the government level also requires enforcement in the assessment of total requirements and products at a given time. The imports, for example, in 1972-73 were 366,715 M/tons. In the following year the imports were almost doubled with an import of 711,920 M/tons and a major increase in phosphatic fertilizers. The situation today is that the stocks of imported nitrogeneous fertilizers are almost exhausted, while the phosphate stocks have piled up all over the country.

More careful planning is also needed to utilize our limited resources of foreign exchange. When importing fertilizers we should procure our requirements from the cheapest source. In 1968/69 urea was imported from the United States at $126 per ton (which has now gone up to 200 dollars per ton) while it was available from Kuwait at $68 per ton. We realize it is sometimes easier to repay U.S. loans, yet the price difference is so big that advance planning could be immensely advantageous to the government. We should tie up with the cheapest source on a long term basis. A lack of national planning is also evident in that neither the geophysical belts of the country nor the crop requirements are being considered while assessing fertilizer needs. We were only emphasizing the application of N in the beginning; now some emphasis is being laid on phosphates while the use of K has almost been ignored. We must have rational recommendations and rational planning on the use of a balanced fertilizer for various crops and in various tracts. Imbalanced application of fertilizer may ultimately do more harm than good to the country's crop production.

It is disappointing to note that no authentic soil map has been prepared for the general guidance of the farmers. There are only two soil testing laboratories. All of this shows that there is a need to improve our fertilizer policy in the light of the farmers needs, soil and

crop requirements, geophysical limitations and the economics of imports.

THE INADEQUACY OF SUPPORTING SERVICES

The judicious use of fertilizer and other inputs is an art. This cannot be practiced unless the knowledge of the farmers' is improved. While we have been trying to improve the availability of fertilizers for many years, no real effort has been made to train the man behind the plough, except in some isolated instances here and there.

The government has allowed Rs. 1/- per ton in the sale of incidentals for sales promotion. This should naturally include the extension activities and training of farmers as well. Nothing much is being done at present. It would be worthwhile pooling all this money and starting a separate agency. This might be called a "Fertilizer Sales Promotion Council", which could independently plan the promotion and correct use of fertilizer in keeping with the soil and plant requirements. The Council could also prepare film strips, slides, posters, pamphlets and other educational materials to help the farmers in adopting judicious ways of applying various types and combinations of fertilizers. This Council should also help in planning distribution and production plans for chemical fertilizer in the country. This is necessary to counteract the lop-sided propaganda of the fertilizer manufacturers and distributors.

THE CONFLICTING CROP REQUIREMENTS

Pakistan has a peculiar crop production strategy. It has to grow dual purpose crops to meet the requirements of the man and farm animals, i.e. grain is utilized by man and fodder by the cattle. Nothing reverts to the land. This depletes the soil continuously. To replenish the soil much more vigorous efforts are required. Fertilizers have to be balanced and proportioned in much higher doses. Right now, the balanced fertilizers are not available and other supplementary practices are not being followed by the farmers. This has caused a serious set-back in replenishing our depleting soils.

Another factor of basic importance for promotion is the fact that we have to produce genetic strains which would respond to fertilizer better. In Pakistan's major staple food crops, the fineness of the stem is directly correlated to the quality and fineness of the grain. The stem in such varieties is tender and fine and, therefore, cannot stand

higher doses of fertilizer. A little excess tends to induce lodging which results in a significant decrease in the yield. Acceptable combinations have, therefore, to be introduced in our future crop strains. Scientists and plant breeders have to join hands to overcome this handicap and accelerate the economic pace of fertilizer in the country. Some efforts have already been made. The tempo of research has to be accelerated to meet the challenge, without any further loss of time.

Efforts have to be made to introduce 'keyline' farming for the natural restoration of nutrient levels in the soil. This practice will also reduce the load of fertilizer, consequently, liquid fertilizers should be produced and popularized to reduce cost. Recent experiments have been made and the results are encouraging. Experiments should also be conducted to introduce soil activators and bacterial cultures to suppliment the fertilizer requirements in the field.

THE IRRATIONAL MARKETING SYSTEM

A number of experiments have been made by the government in this field.

Artificial chemical fertilizers were introduced in 1952. The distribution for the first few months was almost free. A subsidy of 66% was given thereafter which was reduced to 50% in the following years. The distribution was done by the Department of Agriculture in the provinces. In 1956, P.I.D.C. started distribution of fertilizer through its direct sale agents in the Mandi towns.

An Agricultural Development Corporation was established in 1961. All fertilizer distribution was entrusted to this organization through its own agents. In 1963, a co-operative organization called the R.S.C.C. was also associated with this work. In 1968, some private companies were inducted as principal agents. In June of 1972, this agency was abolished and a new organization named the Agricultural Supply Organization was formed. A year later this also was abolished and separate Agricultural Supply Organizations were established in each major province. Fertilizer distribution by principal agents was banned and the trade was said to have been 'nationalized'.

One or two principal agents have, however, started operating again in the field. The companies with foreign participation have been allowed to market their production directly. There is, in short, complete confusion and the farmers are still more confused. All the sale points established by the private trade have been closed. A few new points have been set up. Briefly speaking, the trade is now being controlled either by the bureaucrats or the foreign companies. Both, by tradition, are not regarded as friends by the farmers. The handling cost has in-

creased from Rs. 104 per ton to Rs. 236 per ton. The government investments have gone very high because the fertilizer trade has been run on a cash and carry basis by the private sector. Now all investments made by the government will have to be tied up for a long time. The load of repatriated profits by companies with foreign participation is also going to increase tremendously since previously they were only repatriating the profits of manufacturing units. Now part of the profits made by them in distribution will also go out of the country and there is hardly any justification for this. Manufacturers should not be the distributors for the sake of quality control.

Anyhow, there are a few facts which are bound to create difficulties for the government and may frustrate the farmers as well.

We do require a stream-lining of the whole process. The best way would be for the government to handle the fertilizer from the portend or the factory gate to the community storage levels. Beyond this the private sector should operate on a cash and carry basis. There should be storage facilities and stores in each district which should be linked up with community storage at places of consumption. The take-off beyond these points should be arranged; not through prestigeous companies, but by farmers' own organizations, co-operatives and voluntary extension services on payments against upliftments. This will disengage the government investment quickly. There should be bulk handling for imports and the imports should be arranged from the nearest manufacturing countries to save freight. The local manufacturers should confine their activities to efficient running of their plants rather than involving themselves in the field of distribution.

I know a lot of crows will frown at me when I utter these words. But these are the reactions of a farmer and if they claim to be a friend of the farmers they should swallow these bitter expressions and try to search their hearts if they are really true in what they claim.

Strictly speaking the present system is not nationalization in the real sense. As in the process of nationalization the first axe is applied to the foreign investments, here the attitude has been rather liberal. On the contrary the local companies and organizations have been given still better facilities with which to operate.

Let us hope, however, the new system will prove in the best interests of the farmers as is being intended by the government. We also hope that the further improvements which the government wants will be possible in due course.

LACK OF FINANCIAL RESOURCES

Whatever may be the marketing system, the take-off of fertilizers will depend on the financial resources of the farmer. The farmer of this country, generally speaking, is very poor. 1.5 million families have 2 acres or less. 92% of the farm holdings are less than 25 acres. With ever increasing costs of farm inputs they can hardly be expected to invest all these inputs unless they are provided with adequate financial support. An assessment made in 1969-70 revealed that credit requirements are up to 64,500 M. This year this phenomenon has become more pronounced. The take-off of fertilizers was at its lowest ebb in September and October. In November, a special drive was launched by the Agricultural Development Bank and over 200 million rupees were pumped to support fertilizer sales. The sale was brisk and prompt. 75% of the total sale has been against this credit. Had this facility not been made available the sales would have been restricted in this peak month as well.

Let me warn all concerned, however, that this is not going to happen each year. Unless the recovery position gets satisfactory the bank will not be able to repeat this performance in the next season. With the rising prices of inputs income of the farmer must also improve. This can only be done by proportionately raising the procurement prices for his produce. The price of cotton, sugarcane and rice has improved to some extent but the farmer still sells his wheat at almost 25% of the world prices: for this there is hardly any justification. 80% of the people should not be allowed to suffer for the convenience of 12 to 15% of the city dwellers. The prosperity of this nation will depend on the day when the farmer of this great land gets his due and becomes confident to stand on his own feet.

Mr. Chaudhry is the Honorary Adviser (Special Crops) for the Ministry of Food & Agriculture in the Government of Pakistan.

The Problems of Marketing and Distributing Imported and Domestically Produced Fertilizers - Turkey's Experience

Mr. Mahmut Erdir

It is quite obvious that fertilizers play an important role in obtaining optimum yields from per unit areas. It is, therefore, demanded constantly in great volume by the farmers and this sometimes creates difficulties from marketing and distribution points of view.

According to average figures of the years 1948-1951, 0.14 kilograms of mixed pure nutrients were utilized per hectare, but this amount increased approximately ten times and exceeded one kilogram during 1958-1959. In the first and second Five Year Plan periods it also showed the following increase:

1963 -	4.8	Kgs/Hectar
1967 -	16.2	"
1972 -	25.2	"

This great increase in the consumption of fertilizers created difficulties in the marketing organization of domestic production and/or procurement and in distribution, thus making fertilizers the subject of a great policy in our country.

MARKETING ORGANIZATION

During the years when the consumption rate was under law, no important problems arose in the fields of procurement and distribution. In those years fertilizers were used only by state organizations and by some conscious and learned farmers. Fertilizers were consumed in small quantities, and were easily imported by these organizations. When local fertilizer plants began domestic production, the demands of the farmers

were met in time.

However, when planned development began in 1963, many problems arose when fertilizer planning, supply and demand estimates and utilization targets were determined, and especially when fertilizer became well-known to the farmers.

I The Bottle-Necks Which Arose in The Marketing System

In Turkey, fertilizer import, procurement from domestic sources, distribution, and sales and deliveries are carried out under the decrees issued by the Council of Ministers. At the beginning, the aforementioned commercial activities were under the monopoly of the Agricultural Supply Organization (TZDK) which is a state organization. But, since production costs in local fertilizer plants were high, it became convenient to import fertilizers from foreign markets. Many fertilizer consumers began to participate in procurement and distribution activities one-by-one. Until 2 years before, procurement and distribution was carried out by the following organizations:

1. Agricultural Supply Organization (TZDK)
2. Sugar Company
3. Co-operatives of Tea Producers
4. Agricultural Credit Co-operatives, Mutual Aid Association
5. Tariş (Union of Sales Co-ops of Cotton, Figs, Olives and Raisins)
6. Çukobirlik (Union of Sales Co-ops of Cotton)
7. Antbirlik (Union of Sales Co-ops of Cotton and Citrus)
8. Tobacco Growers Co-operatives
9. Mersin Citrus Growers Co-operatives
10. South-East Agricultural Sales Co-operatives
11. General Stores Company
12. State Farms General Directorate
13. Private Dealers

If larger quantities of fertilizer were produced in, or imported into the country, the realization of the envisaged fertilizer consumption and the consequential attainment of the agricultural production targets would be possible with a well-co-ordinated marketing system developing every year.

Since the fertilizer marketing system consisted of a great number of institutions, the possibilities of co-ordination and inspection completely disappeared, and many problems arose mainly because fertilizer producers are subordinate to the Ministry of Industry, the credit and finance institutions to the Ministries of Commerce and Finance, the procurement and distribution institutions to the Ministries of Industry,

Commerce and Agriculture, and private dealers also exist. Therefore, good co-ordination could not be provided and programmes were hampered, and service could not be tendered as it should be.

II The Bottle-Necks which arose in Procurement and Distribution

1. During preparation of procurement programmes, the quantities estimated to be produced locally were high. However, the investments could not be realized, and failures, raw material shortages, delays in supplying spare parts and strikes were not taken into account. These facts had adverse effects on procurement programmes. Procurement had to be in lower quantities than as programmed and, therefore, consumption was below the plan targets and at times it was necessary to import fertilizers.

2. Due to disorganized and widespread activities in this field, stock control possibilities decreased and blackmarkets occurred.

3. The organizations which participated in the marketing of fertilizers generally acted independently and for their own benefit.

4. The prices of fertilizers imported by the various organizations were different and this caused great losses.

5. Since it is possible to make higher profits from imported fertilizers some of the distributive institutions and co-operatives were reluctant to buy from the local market.

6. Shipments of imported fertilizers were delayed. The fertilizers arrived in Turkey after the consumption season and were transferred to stocks being presented to the market.

7. Due to the great number of institutions involved in buying and distribution, price controls and inspections of technical applications became difficult.

8. Since the prices were fixed by government decrees, some institutions shipped the fertilizers only to those places where they might make a profit and not to where it was really needed. Therefore, many farmers who were in need of fertilizers could not obtain them.

9. Import prices of chemical fertilizers showed a great increase in recent years making it difficult to import them in sufficient quantities and on time.

10. Phosphate fertilizers should be used in the autumn but the obligations to deliver domestic products on the monthly basis, necessitated the holding of these fertilizers in stocks at least for six months. This also caused additional expenses such as storage, manipulation and shrinkage which have adverse price effects.

11. The depot capacities of existing distributive organizations are inadequate and few places have suitable facilities for quick loading and/or unloading.

12. Due to a lack of transportation vehicles, sometimes both imported and local fertilizers could not be transported to distribution points in time.

13. Since the local fertilizers sometimes did not conform with world standards of packing, humidity, high acidity and granulation, there were many difficulties in storage and utilization, many farmers were incline to use the imported fertilizers.

14. In recent years the difference between factory prices and retail prices fixed by decrees became lessened but the supply was not sufficient to meet distribution costs.

If sufficient amounts of fertilizers could be supplied and if many of our problems could be solved, the fertilizer consumption rate might be higher than the present level.

I tried basically to explain the bottle-necks encountered in the importing, domestic production and distribution of fertilizers. In view of these bottle-necks and based on the experiences gained, the Turkish Government re-arranged the fertilizer regime in Turkey by issuing two decrees (dated August 19th,1972 and May 8th, 1973) which cover the principles of marketing, importing, domestic production, procurement and price fixing. Although the procurement and distribution services for imported and domestic fertilizers were assigned to the Agricultural Supply Organization, the Agricultural Credit Co-operatives, the Mutual Aid Association and the Sugar Company by the first decree, due to a discrepancy in implementation this duty was assigned only to the Agricultural Supply Organization and the Sugar Company by the second decree. Today the Agricultural Supply Organization, which is a state organization, is charged with the duty of procuring and distributing 95 per cent of the

fertilizers in Turkey. As a result of these measures, the implementation within one year was very successful and all requirements could be met in time, and at present sufficient stocks are on hand.

The problems which are encountered by the Agricultural Supply Organization can be summarized as an inadequacy of depot capacity, the non-existance of desirable depots to rent, the troubles which can arise in highway transportation, the difficulties which occur in making procurement in sufficient quantities from foreign markets, the inadequacy of the Organization which consists of 22 regional offices, 200 agencies and approximately 3,000 salesmen, and the necessity of re-organization.

Because of these problems the proper authorities re-arranged the investment programmes and we hope that these problems will disappear completely in future. However, we also propose the following recommendations so that the implementation of the fertilizer programme will be even more successful.

RECOMMENDATIONS

1. *Legislations*

a. A "Fertilizer Law" which would determine the authority and responsibilities, make controls and inspections of production, imports and distribution activities, determine the prices of chemical fertilizers and enforce provisions.

b. A "National Board for Fertilizers" should be established within the Ministry of Agriculture and which would have an interministerial status to provide co-operation and co-ordination with the Ministries, universities, institutions, departments and other commercial organizations that are concerned with the production of chemical and organic fertilizers in Turkey, and the importing, distribution and application of them. This board could also carry out consultative work to improve our sources of chemical fertilizers, make plans for this purpose and implement the national fertilizer policy in conformity with the conditions and benefits of our country.

2. *Domestic Production*

In view of the increase in import prices during recent years and the problems of providing sufficient imports, a necessity of meeting our requirements with local suppliments arose. It is, therefore, necessary to take the following measures:

a. Existing domestic fertilizer plants should make every effort to reach a production level in conformity with their capacities.

b. Long-term raw material supply programmes should be prepared and a raw material stock of at least 2 months should be on hand to provide continuity in production.

c. It is necessary to use only polyethelene and jute bags to solve the packing problems which create trouble in both transportation and storage.

d. All measures should be taken to inaugurate the planned fertilizer plants on the target dates.

e. Priority should be given to the fertilizer industry so that new fertilizer plants may be established.

3. *Procurement and Distribution*

a. The main distributive institutions should enlarge their organizations so that it may be possible to reach every district.

b. Each distributive institution should hold sufficient stocks to meet the requirement of the consumers on time taking into consideration the delays which may occur in procurement.

c. The institutions charged with the duty of procurement and distribution, and the producers should employ sufficient technical personnel who have good knowledge of fertilizers and its application and who are able to guide the farmer.

d. Suppliers should enlarge their storage capacity and their depots should be erected in consumption contres - not concentrated near discharge ports.

e. One of the most important points is to train farmers to let them consciously utilize the fertilizer. Although it can be made by agricultural extension, the best way is to be near the farmer during application. It is, therefore, necessary for the Ministry of Agriculture to place emphasis on both extension, and practical training as it was done up to now Also it is necessary to provide the assistance of producers and distributors for the Ministry in this field.

In any case, the goal of the fertilizer regime is to carry the service as near to the farmers as possible within the framework of produc-

tivity, and we are trying to realize this aim.

Mr. Erdir is the Senior Agricultural Engineer & Director of Planning Department, Agricultural Equipment General Directorate.

Fertilizer Distribution and Storage

Dr. D. Robert Schmeltz

When I was first consulted on presenting a paper to this gathering some 6 or 7 months ago, little did I know what would happen to our industry in the interim. All of us now face many situations nearly unprecedented in the history of our industry. There is pressure from every angle, none the least of which is the tightrope we now walk....that very fine line between demographic progressions and man's ability to fill his belly.

The efficient movement of raw materials has always been a prime consideration in the fertilizer industry. Through time, this consideration has become not only more demanding, but more complex. More demanding because the customer wants the product delivered in good condition, at a specific time, and at minimal cost. More complex because increased demand has forced us to seek new and more efficient means to move tonnage.

The perimeters of our industry are well-known to all of us. I recognize that many unique marketing demands and requirements exist from country-to-country. I also recognize the pitfalls which can result from trying to transplant practices from one country to another. However, I would like to restate some of the more important factors related to IMC's market in the U.S.A. While these methods are specific to the U.S. market with proper modification they could have application in other areas of the world.

IMC has two potash mines. One is located in the south-western United States, at Carlsbad, New Mexico. The second is at Esterhazy, Canada, in the province of Saskatchewan.

It seemed to be a simple enough matter to process the ore, load it onto rail cars, and ship the product to the customer.

Unfortunately, the usual period of peak customer demand was a few short weeks during Spring. If all the year's potash requirements were to be shipped during this abbreviated period, the supply of rail cars would have to be multiplied many times.

IMC needs rail cars. The market area for IMC potash is located many hundreds of miles from the mines. Rail car shipments are the only practical way to move a great amount of tonnage.

We attempted to ship potash to customers during the off-season, but the customer's storage facilities did not have the capacity to store a full season's requirements of potash.

The final complication has a demoralizing effect.... it took up to fourteen days from the time a customer placed an order, until his potash was delivered. The requirement of two-weeks delivery time in a short Spring season of six to eight weeks made ordering hazardous or even disastrous.

From a distribution point of view, the outlook was bleak at best. But some solution must exist.... of that we were certain. The task was to find the right ideas and put them to work.

One of IMC's innovative solutions was our potash unit train. By definition, a unit train is a long train, over 100 cars long which carries a single commodity; it never stops to add or subtract cars. It passes every marshalling yard on the through track - moving to its final destination without delay. We knew that we could cut days from the normal schedule from Esterhazy to the mid-west by using a unit train.

We began to make arrangements - and ran into a serious problem. The Canadian railroads did not consider it to be in their best interest to run a unit train. But we found that if we could get the potash to the border, the U.S. railroads would be happy to handle it from there. We decided that trucks were the answer. Now, 40 ton trucks using double trailers load potash at the mine and drive 120 miles due south to the border town of Northgate, North Dakota.

The Canadian Government was reluctant, at first, to allow our heavy trucks to use the highway, fearing that the soft roadbed would be damaged by the heavy truck traffic. But by now the road has been almost totally replaced by IMC.

Once the trucks arrive at Northgate, they unload their potash directly into waiting hopper cars. Each car holds 80 to 100 tons. When 100 to 110 cars have been loaded, the train is ready to roll. From Northgate the train moves directly to one of eight key locations in the mid-west market area.

The answer to the problem of our customers' limited storage facilities was in-market storage tracks. Unused sidings were leased in order to store fully-loaded cars right there in the market area.

Arriving at Monon, for example, the train which has travelled as a unit from Northgate, is broken up. The majority of the cars are sent directly to customer plants. The remaining cars are stored on the leased, in-market, storage tracks.

With potash on hand in the market area, delivery can be made in one to three days instead of the 14 days required if the potash has to come from the mine in Canada.

IMC recovers its costs of car ownership and leased tracks through economies realized from the unit train, and delivers potash to the customer at competitive prices.... within three days of the customer's order, *not* two weeks later.

This advantage is extremely important to customers during the busy season. In fact, customers would like to know hour-by-hour where their car is, and when it will arrive. In order to accommodate our customers, and so that IMC would know where all the cars were located, we devised a car location reporting system.

An electronic communications network was set up in co-operation with the railroads. Now, every morning, our computers are programmed with the location of every one of the 3,200 cars in our fleet. The system is called TELSCAR, and we know day-by-day where every car is located and if there are any delays.

If a car should breakdown we can order out a replacement car, often with no loss of time and certainly within fourteen days if another car has to be shipped from the mine.

Our customers tell us our service is one of the very few sources of peace of mind during the turmoil of the busy season. They know when the car will arrive, they can plan production and they know they can meet emergency requirements. Needless to say, we are delighted with the success of the TELSCAR programme.

As we looked at our distribution system, we saw areas here and there where our unit train was less effective than we would like. The problem seemed to centre around the fact that the railroads did not have the concentration of trackage in certain areas.... nor was there an abundance of available sidings for lease. In fact, some trackage is still being abandoned in the U.S. We reminded ourselves that our objective was to move tonnage.... not just run unit trains.

We looked at the rivers and river barges for possible solutions, and found that by using a combination of the unit train, ore boats and river barges, we could move potash into valuable markets with a high degress of cost-effectiveness.

At Superior, Wisconsin, the hopper cars from the unit train load directly on to the ore boats, which, in turn, take the potash to key locations. We needed in-market storage at Buffalo, New York; Saginaw, Michigan; Sarinia, Canada; and Florence, Alabama. None of the four locations had any warehousing or inside dock storage available and we thought storing potash outside was out of the question.

We embarked upon an experimental programme lasting three years. We searched for a suitable covering for potash to protect it from the weather. During our investigations, we used everything we could think of including spray-on plastic and a variety of chemicals. The result of our programme was a solution to the problem of storing potash outside.

At these four locations we placed soil-cement on asphalt pads and unloaded the potash from a self-unloading vessel using the ship's conveyor boom. In other locations we have used the ships' cranes or shore cranes and unloaded the product directly into trucks. The trucks deliver the product to the pad where it is piled by a bulldozer. Once the pile is made a bulldozer shapes the top of the pile. The key to keeping the cover in tact is the uniform shaping of the pile.

Plastic sheeting is then placed over the entire pile. Chicken wire is laid over the plastic, and a combination of common lumber boards and old tires are used as ballast to hold the plastic tightly around the potash. The wind can blow and the rain can fall, but the potash remains undisturbed underneath.

When we first started the outdoor storage programme we were concerned about the potash when the cover was opened to permit the loading of trucks. We found that if we permitted the cover to hang down over the area to be worked (to within five or six feet of the pad) the loader had sufficient room to operate his equipment. Customers picked up the potash in their own trucks. It's just about the most convenient arrangement imaginable.

When the customer finds himself running low on potash, he sends his truck to the waterside storage pad and loads up. It could not be more convenient if the mine were located only a mile away.

One real advantage to IMC was that we could build the pile during the off-season in July or August. When the season begins in September, the potash is there.

I should point out that our outdoor storage is more than a marketing gimmick. It represents a trend toward supplier storage of raw materials which brings real, tangible benefits for the customer. If he does not have to store the raw materials, he can use his storage space for finished products. This fact alone means that he can save a significant amount of money on storage and, of course, he never has to pay any demurrage.

With raw materials closeby and storage for finished products available, the customer can use the relative calm of the off-season for production of his finished materials. His production schedule is easier to plan. There will be no need to make a sudden shift from producing one grade to another because needed raw materials fail to arrive on time.

The last phase in the business of fertilizer manufacturing and distribution was to build new storage facilities. The requirements for new facility construction were simple.... they had to be inexpensive and easy to operate.

While outdoor storage on the farm was a definite possibility, just as it was on a larger scale at the waterside, it was inconvenient to handle. So we erected overhead hoppers on the farm and at retail outlets. These "rainbowlader" vary in size from single hopper models which hold 50 tons, to double and triple hopper units which hold up to 85 tons per hopper. The hoppers are filled by pneumatic truck, which has an air compressor and uses air pressure to force the product out once it is overhead. The farmer can depend on gravity to feed the product into his truck or spreader. The clamshell valve at the bottom is easily operated by one man. Several tons can be loaded by one man in a few minutes.

Ground level storage is possible with prefabricated structures called Wahoo Bins. These bins are low-cost structures made of wood which have capacities ranging from 25 to over 300 tons.

Wahoo Bins are loaded by pneumatic truck, auger or belt conveyor - the auger and belt conveyors are also used for unloading. If the bin is constructed with an opening large enough, unloading can also be accomplished by using a front-end loader.

At the beginning of my remarks, I pointed out that the techniques used domestically can be used elsewhere in the world.... obviously with some modifications.... to fit the local situation.

There are a couple of worldwide distribution techniques I would like to mention because they illustrate the fact that the same principles apply. The principle I am referring to is in-market storage.

We have found economies using international distribution methods to serve a U.S. market, for example: we ship potash via rail from the mine in Saskatehewan to Vancouver, British Columbia. From there it goes by ship through the Panama Canal to Tampa, Florida because this route is less expensive than rail transportation. In fact, there are sufficient savings to off-set the cost of the Tampa warehouse complex. The price of Canadian potash is controlled by the Canadian Government.... we have no choice but to find the cheapest mode of transportation.

Ships are the obvious answer to serving the in-market storage needs of customers in southeast Asia and Latin America. Large vessels are chartered to move several thousand tons of potash into a market area. From the warehouse, the potash moves to the customer in smaller quantities. Using ships to move large amounts of potash internationally, is much like the use of the unit train in the U.S. Large quantities to be shipped can give a strong position when negotiating freight rates. The savings are turned into storage facilities for the customer.

The second major benefit is that when the customer places his order the potash is already nearby. There is no need to look for rail cars and ships, and wait for weeks for delivery.

Frequently it requires time and experimentation to find just the right combination to fit the needs of the market. In Singapore, for example, we have a large terminal warehouse facility located at the Jurong wharves. Here ships can discharge their cargo directly into our warehouse through a conveyor belt system. From here the product can be handled in a wide variety of ways. It can be bagged for shipment by trucks or smaller coastal shipping - or it can be trans-shipped in bulk - to meet the in-market needs of the customer.

In Brazil on the other hand, the ship discharges its potash into trucks which carry it to the in-market warehouse. In Columbia, barges are the link between the ship and the warehouse. The only criterion is whether or not the system serves the customer.

During the last several minutes, we have discussed the various materials management techniques in use at IMC. Each example is a workable programme. There are others.... but I have mentioned these in hopes that they might provide a possible solution to your own distribution challenges.

Mr. Schmeltz is the Director of the International Minerals and Chemical Corporation Limited, in Singapore.

The Economics of Fertilizer Use on Major Crops in Iran

Mr. Iraj Nassiri-Toosi

METHODS OF DETERMINING THE ECONOMY OF FERTILIZER USE

TABLE 1

AREA UNDER MAJOR CROP CULTIVATION IN THE YEAR 1971-72

CROP	AREA/HA
Wheat - irrigated	1,429,298 *
" - dry	4,135,864
Rice	344,497
Cotton	307,469
Alfalfa	277,667
Sugar-beets	147,549

* *SOURCE: Statistic year book of 1350, IRAN.*

In Iran, rapid surveys were carried out to establish levels which could be considered as experimental rates. Then thousands of experimental plots were laid out according to these levels within several years, both under farmers' conditions and controlled conditions to find out what kind and what rates of fertilizers would prove most economical.

Fertilizer experiments consisted of combinations of different levels of nitrogen, phosphorus and potash in simple trials in scattered farmers' fields. The fertilizer treatments were superimposed on the farmers' normal practices of cultivation,* including irrigation, variety, etc. But no other manuring was done in the experimental plots. For each

* *More detailed and controlled experiments were carried out in pilot stations.*

area the results for each year were examined. Generally there was no interaction of nutrients within the levels tested and, therefore, the average response to each nutrient was taken as the best estimate of the effects of that nutrient. To determine the best estimate, other experiments such as testing different sources of N or P were also carried out and the results were included in the findings.

Generally there was no difference among the different sources of nitrogen. Where there was a difference, as in the case of basic slag and triple superphosphate, the results of only the most commonly used nutrient source were taken.

The responses were then averaged against the number of trials. A simple mean of the yearly averages was taken to estimate the average responses for an area.

The average responses in each area were weighed with the relative crop areas and this average was taken as the average response for the country. In most cases, due to larger numbers of exports, area recommendations were possible for each crop.

THE ECONOMICS OF FERTILIZER USE

The extent of fertilizer use by farmers depends largely on the net profit gained from fertilizer application and the net profit depends mainly on the following:

1. Crop response to fertilizers
2. Cost of fertilizer application
3. Price of produce
4. Residual effects of fertilizer use on the next crop, if any.

"Optimum fertilizer dose" is that which maximizes the net profit and is the dose usually recommended for the best economical application on crops. Maximum profit is obtained when the added return in the yield just equals the cost of the last of fertilizer increase.

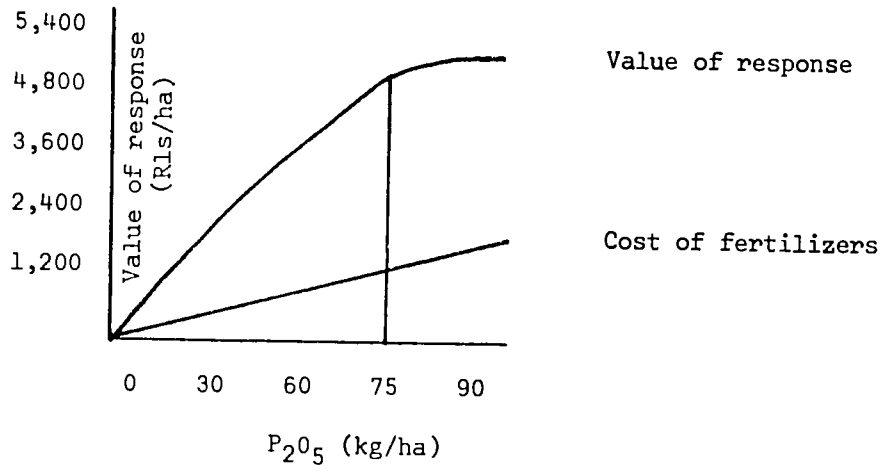
The marginal yield increases and marginal costs for each fertilizer dose increase in 34 trials of phosphorus on the wheat crop in Esfahan area are examined below:

TABLE 2

P_2O_5 kg/ha	Marginal Yield/kg/ha	Marginal* Cost Rls/ha	Marginal Return Rls/100 Rls	Net Profit* Rls Per Hectare
30	461	652	424	2,114
60	276	652	284	3,118
90	111	652	102	3,132

At the level 90 kg/ha, the marginal return is nearly 1, indicating that the original cost at this level of application is equal to marginal return and the profit per hectare is maximum showing that the 90 kg/ha is the profit maximizing dose.

A more accurate approach will be to use the field and dose data to draw a fertilizer response curve, in which the expected yield increments can be estimated for any level of fertilizer application within the range of doses tested for the above data.



In this curve the optimum or the profit maximizing dose as shown will be 75 kg P_2O_5/ha with a net profit of 3,260 rials and a return of 300 rials per 100 rials invested. However, the high return of investment should also be considered by a farmer who has less capital. Usually a net return of 2-4 times of the investment should be considered safe for the farmer. Return can easily be calculated as the following:

$$\text{Return} = \frac{\text{Value of yield increase}}{\text{Cost of Fertilizers}} \times 100$$

The response curves of wheat, rice, sugar-beet, potatoes and cotton to nitrogen and phosphorus are shown in Figures 1,2 and 3.

It is to be noted that in these figures, responses are given to N and P separately as there has been no interaction between these two nutrients. Potash has no significant response, so it is not included.

TABLE 3

MAXIMUM RETURN AND MAXIMUM NET PROFIT OF FERTILIZER USE ON SOME PRINCIPAL CROPS IN IRAN

CROP	MAX. RETURN/ 100 Rls *	MAX. PROFIT Rls/Ha.
Wheat (Irrigated)	279	3,816
Wheat (Dry)	244	572
Sugar-beets	398	16,154
Cotton	484	18,798
Rice (Short Grain)	529	9,629
Rice (Long Grain)	396	6,587
Potatoes (Local)	955	19,872
Potatoes (Alpha)	1,388	46,835
Sunflowers	306	3,022
Tobacco	941	16,093
Onions	970	54,909
Watermelon	3,251	61,644
Cucumber	1,433	52,161
Kenef	393	7,660
Alfalfa	817	15,592
Beans	177	1,638
Tea	885	20,408
Grapes	2,160	60,000
Oranges	4,625	118,000

* *$ = Rials 70*

FIGURE I

RESPONSES OF RICE AND WHEAT TO FERTILIZERS (UNIT kg/ha)

			Control Yield
(I)	R=17.63	N - 0.122 N^2	3,344
(II)	R=21.67	P - 0.244 P^2	3,344
(III)	R=12.57	N - 0.097 N^2	2,866
(IV)	R=15.47	P - 0.147 P^2	2,866
(V)	R=11.30	N - 0.085 N^2	1,766
(VI)	R= 6.37	P - 0.039 P^2	1,672

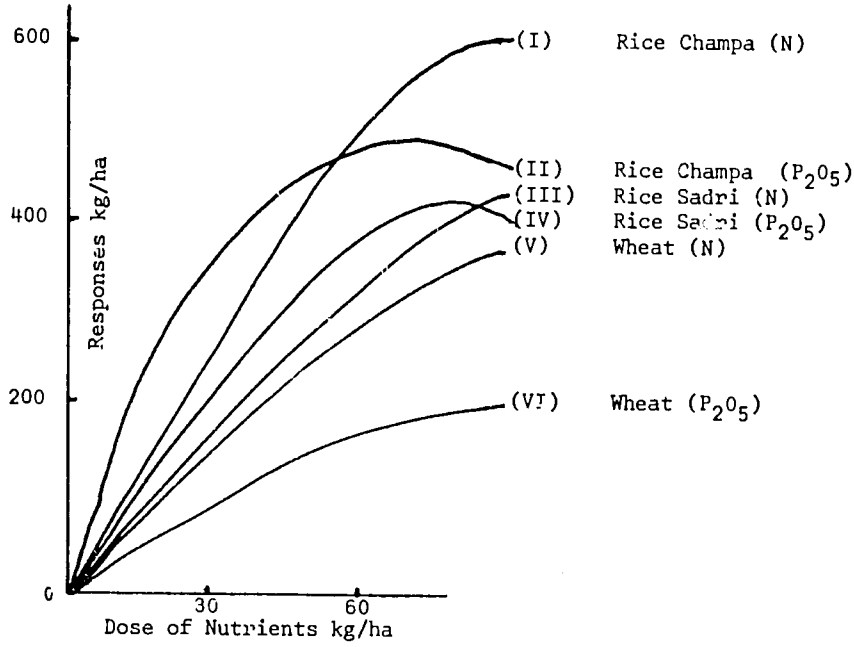


FIGURE 2

RESPONSE OF SUGAR-BEETS AND POTATOES TO FERTILIZERS

			Control Yield
(I)	R=4.18	N - 0.52 N^2	32.53 Tons/ha
(II)	R=5.29	P - 1.35 P^2	32.13 "
(III)	R=2.85	N - 0.62 N^2	11.83 "
(IV)	R=1.04	P - 0.18 P^2	12.91 "

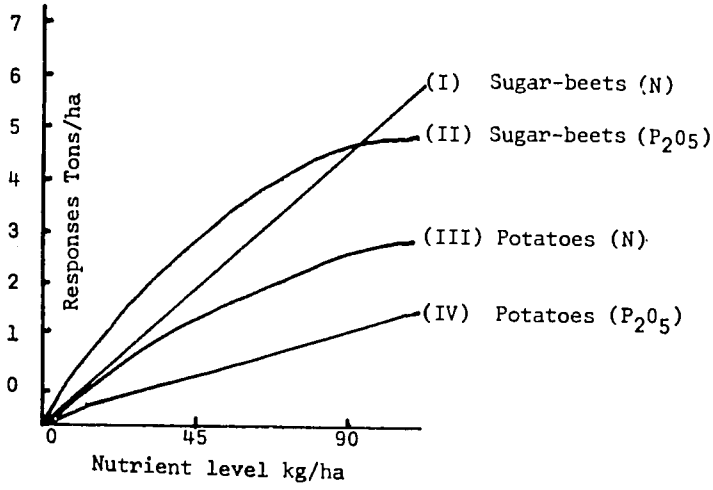
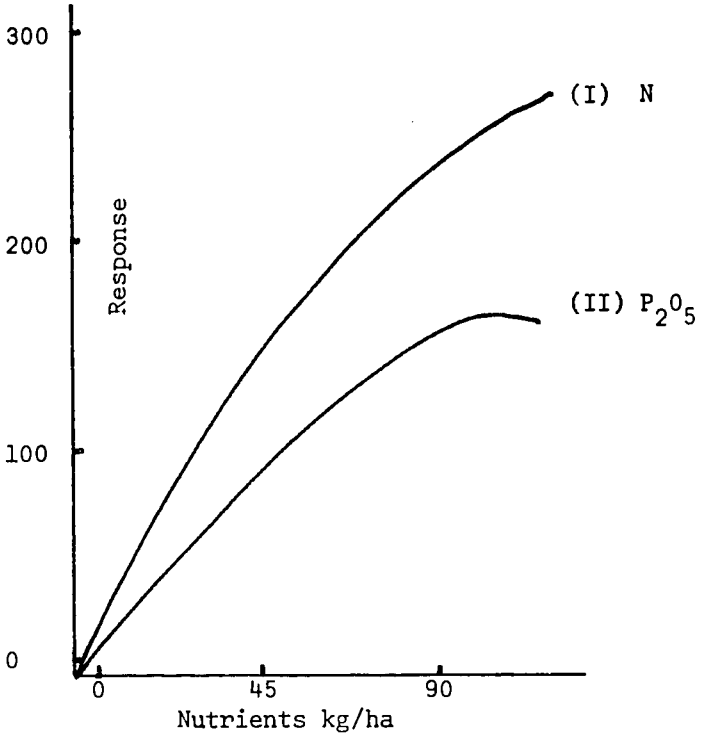


FIGURE 3

RESPONSES OF COTTON (UNLINTED) TO FERTILIZERS (UNIT LEVEL kg/ha)

			Control Yield
(I)	R=4.38	$N - 0.015\ N^2$	1,400 kg/ha
(II)	R=4.09	$P - 0.023\ P^2$	1,420 "



The mean responses obtained over several years are as the following:

Wheat: The average response of irrigated wheat to nitrogen application at 30 kg N/ha is 262 kg of wheat/ha. With an increased nitrogen level from 30 to 60 kg/ha., an additional response of 108 kg/ha is obtained. Application of phosphorus at 30 kg/ha gave an increase of 156 kg wheat/ha and an extra 30 kg/ha of P gave only a response of 80 kg of wheat/ha. Unirrigated wheat has shown little response to fertilizers on the average.

Rice: The mean response to 30 kg N/ha was an increase of 419 of champa (short grain) and 290 kg/ha of sadri (long grain). Phosphorus had nearly the same response with 30 kg/ha, and gave a small response on sadri rice.

Sugar-beets: On the average, over 6 tons/ha of sugar-beets were obtained with 90 kg/ha. Phosphate gave an average of a little over 5 tons/ha to 90 kg P_2O_5/ha.

Cotton: Irrigated cotton gave a response of 166 kg/ha of cotton to 45 kg N/ha and 270 kg of cotton to 90 kg N/ha. Application of phosphorus gave a response of 137 kg/ha to 45 kg of P_2O_5/ha, increasing the levels of P_2O_5 application showed only very small increase.

Though area-wise recommendations on the rates of fertilizer crops are available for different crops in the country, for the purpose of an overall economical evaluation the recommendations according to the main findings and economy of recommended rates are set forth as follows:

TABLE 4

COUNTRY-WISE FERTILIZER RECOMMENDATIONS FOR MAJOR CROPS IN IRAN

CROP	N kg/ha	P_2O_5 kg/ha	FERTILIZER* EQUIVALENTS kg/ha
Wheat, Irrigated	60	60	260
Wheat, Dry +	15	15	60
Rice	60	45	230
Cotton	45	45	200
Sugar-beets	120	120	520

* *On base of urea 46% and TSP 46%*
\+ *Not recommended for the whole crop area*

TABLE 5 *ECONOMICS OF FERTILIZER USE WITH RECOMMENDED OPTIMUM DRESSINGS OF FERTILIZERS ON MAJOR CROPS*

CROP	EXPECTED YIELD INCREASE kg/ha	CROP PRICE Rls/kg	FERTILIZER COST + Rls/Ha	NET PROFIT/Ha
Wheat(Irrigated)	800	7	2,210	3,390
" (Dry)	300	7	510	1,590
Rice	1,000*	20*	1,955	18,045
Cotton	400	15	1,700	4,300
Sugar-beets	12,000	1,500/ton	4,420	13,580

* *Average sadri and champa varieties*
\+ *8.5 Rls/kg (including transportation costs).*

TABLE 6

ESTIMATION OF THE ECONOMY OF FERTILIZER USE ON MAJOR CROPS

CROP	AREA TO BE FERTILIZED (ha)	ADDITIONAL CROP PRODUCED TON/YEAR	FARMERS' NET PROFIT U.S.$ 1,000
Wheat (Irrigated)	1,400,000	1,120,000	67,800
Wheat (Dry)	1,500,000	450,000	34,070
Cotton	300,000	120,000	18,248
Sugar-beets	100,000	1,200,000	19,400
Rice	150,000	150,000	38,668
TOTAL			178,186

The following should be considered with this estimation of the economy of fertilizer use:

1. The rates recommended and the relative yield increase are under the average farmers' conditions. With better cultivation methods and higher fertilizer doses more yield increase and profit are to be gained.

2. In most cases the exact fertilizer recommendations are not applied by the farmers where they use fertilizers on major crops because less fertilizer is used. The exact application of fertilizer recommendations by the farmers should increase yields and profits.

3. Impact projects on rice and wheat have subsidized the price of fertilizers more than 30% - this has not been taken into consideration in Table 6.

4. Recently the government has decided to give a bonus of Rls. 1,500/tons for the wheat sold to the government by the farmers. This by itself should considerably increase the farmers' profit in wheat production.

5. Alfalfa is a cash crop with a vast area under cultivation which, because of being a fodder crop, was not much discussed. However, with application of the proper rate (200 kg/ha of am. ph.) a profit of more than $60,000,000 can be gained by the farmers. The consumption of fertilizer on this crop at present is negligible.

6. Potatoes and onions are among the major cash crops. Although the areas under cultivation fluctuate each year, they give a very high response to fertilizers and have a high monitary return.

7. The economy of possible residual effects of fertilizers are not calculated.

By taking all these into consideration, a good $300,000,000 profit is to be expected from fertilizer use on major crops in Iran, a figure which is worth doing everything to achieve. More evidence of the profitability of fertilizer use in Iran is shown below:

TABLE 7 *EFFECT OF FERTILIZER USE ON FARMERS' PROFIT**

CROP	VALUE OF YIELD INCREASE / COST OF FERTILIZER APPLIED
Wheat	2.19
Rice (Champa)	6.50
Rice (Sadri)	5.11
Sugar-beets	4.78
Cotton	2.33
Potatoes	5.94

** Results of Soil Institute's trials 1960 - 69 data.*

TABLE 8

PRODUCTION FROM FERTILIZER USE (kg/ha) UNDER AVERAGE FARMING CONDITIONS.

CROP	N	P_2O_5
Wheat (Irrigated)	7.9	5.6
Rice (Sadri)	7.9	9.3
Rice (Champa)	11.0	12.9
Sugar-beets	62.0	76.0
Cotton	3.4	3.2
Potatoes	37.0	17.0

ACKNOWLEDGEMENT

Some of the data, figures and tables presented here are taken from publication No. 166 by T.P. Abraham and A. Gamshadzehi, Soil Institute of Iran. Other sources used were publication No. 339, by I. Nassiri - Toossi, Soil Institute of Iran, and the technical reports of Fertilizer Experts from the Soil Institute and the CENTO Report on the Second Meeting of the Ad Hoc Working Group on Fertilizers, 1971.

Mr. Nassiri-Toossi is with the Soil Institute of Iran.

Farmers and Fertilizers (Meeting the Farmer s' Needs)

Mr. Kemâl Acerer

The social and economic aspects of the agricultural sector have a dominant place in the life of Turkey. Farmers are deeply attached to their lands. This is a social and psychological fact which should never be ignored or neglected. The land is the sole nourishment of the farmer.

Farmers are generally kept within the limits of traditional behaviour and attitudes. In most cases, these traditions are the constraints of efficient production. In order to achieve, let alone maintain efficiency, farmers should be rescued from the traditional values which hinder the proper growth of the agricultural sector.

The objective of fertilizer meetings is to instill a change in the farmers' behaviours and attitudes. Generally, such meetings are conducted by the extension service officials of the Ministry of Agriculture. Besides these meetings, farmers have informal gatherings in the tea houses during which they discuss their agricultural problems especially related to fertilizer usage. The Ministry of Agriculture puts great emphasis on these meetings, because such attempts can influence an increase in the quality and quantity of the production.

Within the Ministry of Agriculture, the Fertilizer Department is the central organization responsible only for fertilizer extension. The provincial organization is composed of 70 agricultural engineers (specialists in fertilizer) distributed throughout 67 provinces, and on the country level there are 642 technicians - all high school graduates.

These members are responsible for the education and training of the farmers. Their job is to inform the farmers of the proper usage of fertilizers. By "proper usage" it is meant "how", "where", "when", in what quantity and what kind of fertilizer should be used.

TABLE 1

THE NUMBER OF DEMONSTRATIONS AND FIELD DAYS

CROPS	1961-64		1964-65		1965-66		1966-67		1967-68		1969	
	# of Demos.	# of Field Days	# of Demos.	# of Field Days	# of Demos.	# of Field Days	# of Demos.	# of Field Days	# of Demos.	# of Field Days	# of Demos.	# of Field Days
Cereal	2,364	788	2,364	804	3,965	1,302	3,315	1,105	2,100	900	-	-
Forage Crops	-	-	-	-	445	115	480	92	485	80	665	215
Cotton	1,620	540	1,620	500	535	200	345	115	150	70	180	85
Groundnut	291	103	291	140	105	10	70	85	60	20	35	15
Potatoes	513	225	513	225	355	105	390	108	311	100	307	100
Apples	-	-	-	-	-	-	40	5	111	10	151	50
Beans	-	-	-	-	-	-	10	4	4	4	8	4
Bananas	-	-	-	-	-	-	10	4	10	5	10	6
Olive trees	-	-	-	-	175	35	230	85	170	28	120	60
Rice	309	103	309	103	215	15	170	25	109	41	38	14
Hemp	-	-	-	-	-	-	-	-	-	-	-	-
Maize	1,666	555	1,666	555	1	-	400	142	354	107	481	145
Sunflowers	810	225	810	225	135	42	155	64	130	85	120	38
Sesame	-	-	-	-	-	-	80	28	80	42	18	18
Grapes	-	-	-	-	-	-	70	14	25	10	243	75
Vegetables	-	-	-	-	-	-	-	-	32	24	264	64
Citrus fruits	-	-	-	-	-	-	-	-	-	-	15	5

The training process takes place both in the fields and the tea houses. The methods vary according to the place where the training is held. In the fields the techniques are demonstrated and technical aid is given to the farmers. These demonstrations are applied in the farmers' fields and according to their own conditions. In this way the farmers have the opportunity to witness the comparison of yields. Demonstration effects are so valid that this seems the best way to get rid of the constraints of traditional behaviours and attitudes.

On the other hand, at the tea houses, the extension workers show films, slides, exhibit samples of the various fertilizers, hand out pamphlets, booklets, tell stories about the outstanding success in the usage of fertilizers to motivate the farmers, give recommendations and instructions and answer questions.

TABLE 2

Years	Number of Meetings	Number of Participants
1961	1,354	84,441
1962	3,394	100,000
1963	4,361	192,799
1964	3,178	117,920
1965	2,014	114,287
1966	3,824	131,336
1967	5,042	176,648
1968	5,054	183,648
1969	5,380	198,653
1970	6,756	247,419
1971	7,122	276,835
1972	7,285	299,950

Turkish farms now are aware of their needs. Now they are beginning to realize the importance of fertilizers as an input. But farmers often encounter a bottleneck in receiving the desired kind of fertilizer in time. Transportation of fertilizer becomes a great burden for the farmer. Therefore, delivery of the fertilizers should be made to the villages. Farmers also need to learn the new information from the Agricultural Research Centre.

In order to decrease the cost of production, the farmers demand improved machinery and tools with long-term credits obtained from official credit institutions.

Farmers feel the necessity of plans and foresight to increase the profit and cost ratio; in other words, the tendency of farmers to seek a better output-input ratio is rising.

Farmers demand a re-organization in the distribution of fertilizer credits which has been given in kind. Both the agricultural credit and the sales co-operatives should be re-organized. These organizations and their targets should be adapted to the dynamics of the environment. Realistic targets should be set and the organizations which are supposed to accomplish them should be established within the limits of scientific principles.

Mr. Acarer is the Senior Agricultural Engineer in the Izmir Section of the Agricultural Research Institute.

The Economics of Fertilizer Use on Major Crops in Pakistan

Mr. K. M. Azam

As I am stepping in at the last moment for a colleague who has fallen ill, I hope I will be excused for the large amount of deficiencies and gaps which remain in this analysis. At this moment, we, in the Planning Commission, are busy evaluating our achievements in the crop production sector during the 4th Year Plan (1970-75) and in making projections for the 5th Year Plan (1975-80). The crucial factors in these projections are the levels of technology, availability of irrigation water and fertilizer usage. While the first two can be estimated with a fair degree of precision, we have trouble making incremental estimates on crop outputs attributable to fertilizer usage, and yet we realize the reliability of the crop production projections largely depends on the reliability of our estimates concerning fertilizer usage and response ratios on various crops.

From the economist's angle, economic efficiency or allocative efficiency is attained only when the following three conditions are fulfilled:

1. When there is efficiency in distribution. This is attained when the commodities are allocated among consumers in such a way that it is not possible to fairly re-allocate them. In economics, this condition is fulfilled when all consumers have same marginal rates of substitution (MRS) for any pair of commodities.

2. When there is efficiency in production, an efficient economic system will allocate resources so as to obtain outputs on the 'Production Possibility Frontier', rather than waste it. The 'Production Possibility Frontier' shows the greatest amount of one commodity that could be produced in conjunction with any

prescribed amounts of all other commodities in the economy. This condition is fulfilled when marginal rates of technical substitution (MRTS) between any pair of inputs is the same for all producers using these inputs. The objective is to maximize the production of every commodity needed by the society without reducing the output of any other commodity. In other words the marginal rates of technical substitution between, say, capital and labour should be the same for all producers using these two inputs. From this it follows that an input's value of marginal product (VMP) should be the same in all applicable industries. In other words, the marginal product of nitrogen used in the production of wheat multiplied by the price of wheat should be equal to the marginal product of nitrogen used in production of sugar-cane multiplied by the price of sugar-cane. Clearly, if this condition is not attained, a re-allocation of resources would result in a greater aggregate output, without a reduction in the output of any commodity. Thus, in the production of any commodity, we must use factors that are the least productive in alternative applications. In other words, we must use factors with the lowest 'opportunity cost'. The comparative advantage rule in international trade is just another version of the opportunity cost principle. The opportunity cost of a pound of sugar is the amount of wheat that has been foregone in order to produce it. The comparative advantage rule tells us to produce sugar-cane in such a way that the sacrifice of wheat or the opportunity cost is as small as possible.

3. That there is a sovereignty of consumers in the economy. This is actually a combination of the previous two conditions. The marginal rate of transformation (MRT) in production must equal the marginal rate of substitution (MRS) in consumption for every pair of commodities and for any individual who consumes them;

$$\text{MRT (X for Y)} = \frac{P_y}{P_x} = \text{MRS (X for Y)}$$

The first condition is achieved by charging all consumers the same prices. The second condition is achieved by charging all firms the same prices for the productive factors they use, while the third condition is achieved by permitting prices to vary until the quantities supplied and demanded are equated for all commodities.

Flowing from the second condition of pareto-optimal equilibrium with regard to efficiency in production, is the criterion of efficient resource allocation - this equates marginal value productivity of a factor with its marginal cost. Thus, if the marginal value productivity of

a factor is not equal to its marginal costs, there is a misallocation of resources with resultant inefficiency. In order to achieve optimality in resources, the appropriate quantities of inputs are determined by equating their marginal value product (MVP) to the price. If $\frac{dy}{dx_i}$ is the marginal productivity of input x_i and p_i is its price, and b_i is the input elasticity of output derived through Cobb Douglas production functions, the condition of optimality requires that $\frac{dy}{dx_i} = bi \frac{y}{x_i} = p_i$. The optimal quantity of that input can be determined from:

$$X_i = b_i Y P_i$$

We have discussed the fact that general equilibrium in the economy is attained only when the three perato-optimality conditions are fulfilled for the whole economic system. In view of the high demands in terms of data and time for such a general equilibrium approach, one should be reasonably satisfied if the optimum level of fertilizer usage is determined by restricting this approach to the agricultural sector only.

The computation of marginal cost at the farm level does not pose any unmanageable problem. This is taken as equivalent to the actual 'bazaar' sale price (as opposed to the government fixed price) plus transportation costs from the sale point to the farm. The average cost which is the actual sale price plus the transportation charges is equivalent to the marginal cost. However, for the economy as a whole, this cost is not easy to calculate. The national or social cost of fertilizers differs from the farm cost. Even if the price of fertilizer is adjusted for subsidies, this may still be different from the opportunity cost/shadow price which is considered to be its real cost to the economy. For the marginal value product at the farm level one may resort to three estimates:

a. The MVP obtained from farm experiments;

b. the MVP obtained through farmers interviews; and

c. the MVP computed by fitting a production function to the input-output data, usually of the Cobb Douglas form i.e. $Y = ax_1^{b_1} x_2^{b_2} ----- X_n^{b_n}$

These three estimates are expected to yield different results due to the nature of their source of information. For estimating the social marginal value product the output should be valued at international prices. Once the marginal cost and marginal value product are computed, the optimal use of fertilizer giving maximum returns both to the nation and the farmer can be determined. A comparison of the actual usage with the optimal usage would enable the policy-makers to judge the distance the country has to travel in order to reach optimality.

While estimating the crop production levels for West Pakistan, various government agencies have used average grain-nutrient ratios varying from 16:1 to 10:1 for dwarf wheats and 8:1 to 6:1 for native wheats. These estimates are fully substantiated by the results of Cobb Douglas production functions made by Dr. Jerry Eckert* with the data collected by him during Rabi 1968-69 in a survey of 135 farmers in Punjab. However, Dr. Eckert's work has shown considerable differences between average and marginal products (Table 1).

TABLE 1

AVERAGE AND MARGINAL PHYSICAL PRODUCTS FOR NITROGEN APPLIED TO MEXICAN AND NATIVE WHEATS

	GEOMETRIC MEAN N APPLICATION (lbs)	ESTIMATED YIELD (Mds)	AVERAGE PHYSICAL PRODUCT (lbs)	MARGINAL PHYSICAL PRODUCT (lbs)
Mexico	28.37	27.12	17.0	5.76
Native	14.50	15.33	8.3	3.29

SOURCE: Jerry P. Eckert, The Economics of Fertilizing Dwarf Wheats in Pakistan's Punjab, (Lahore: The Ford Foundation 1971) page 12.*

As fertilization levels per acre increase, one should expect the additional nutrient increment to contribute amounts equal to or smaller than the marginal product. Hence the average ratios will decline gradually giving the sizeable differences between marginal and average estimates. It would be erroneous to use the latter for fertilizer price policy adjustments and some may also consider it erroneous to use average response ratios in crop projections, but I am of the view that in a country where fertilization bounds are very low and large crop acreages are not fertilized at all, we should use average response ratios rather than the marginal response ratios.

Dr. Eckert has shown that at the geometric mean of the fertilization levels chosen by his respondents and using the dwarf wheat price of Rs.16/- per maund and the native wheat price of Rs.17/- per maund, the marginal value products of nitrogen were Rs.1.12 and Rs.0.68 respectively. During Rabi 1968-69, the government fixed price for nitrogen was 50 paisas per pound, regardless of the type of fertilizer. Simultaneously a blackmarket price of 61 paisas per pound prevailed which raised the price to most farmers by 23 per cent. Another 5 paisas per pound may be added for market-to-farm transportation, bringing the total cost to approximately 66 paisas per pound.

The MVP estimated at the geometric mean application to native wheats was 68 paisas. One must conclude that farmers had exactly equated

marginal costs with marginal returns on this variety of wheat. The arithmetic average of native wheat fertilization in this sample is 37 pounds of nitrogen per acre. This, according to Dr. Eckert, provides quantitative substantiation of the conventional belief that in West Pakistan native wheats may receive up to 30-35 pounds of nitrogen while heavier fertilization is not advisable. Present varieties of native wheats were released in the 1940's and 1950's. Chemical fertilizer has been available since 1952. Farmers have thus had ample time to experiment with various combinations of the two in many environments and to determine the most profitable fertilization.

Dwarf wheats are a new addition to the scene. Their two most often discussed characteristics are their fertilizer responsiveness and their greater need for water. Accordingly, by 1968-69, farmers had increased nitrogen fertilization to an average of 49.5 pounds per acre and irrigations had been increased from 6.5 to 7.5. The MVP of nitrogen at this level remained 1.12 rupees, considerably above the Rs.0.66 marginal cost. Clearly, farmers were still in the process of approximating their new high profit point through trials on their own fields. According to these estimates the new equilibrium would be attained at a geometric mean nitrogen fertilization of about 100 pounds per acre, or twice the level that prevailed in 1968-69.

At least part of the real price of fertilizer can be determined by working out the amount of a crop that would be required to buy a pound of nitrogen, etc. at the prevailing prices. In Appendix I, we have determined the relationship between the prices of various crops and nitrogen in Pakistan over the years 1961-62 to 1973-74. These data reveal that while in 1961-62 it took 1.35, 0.40, 1.53 and 0.56 pounds of wheat, rice, maize and seed cotton respectively to buy a pound of nitrogen, in 1973-74 it took 4.36, 0.93, 3.52, and 0.98 pounds respectively to buy a pound of nitrogen.

Although, I do not possess up-to-date farmers' prices for commodities and fertilizers in other countries, I believe that present fertilizer costs in Pakistan are rather high. We have also calculated both the average cost-benefit ratios (Appendix II) and the marginal cost-benefit ratios (Apendix III) for various levels of fertilizer use on wheat, rice (Basmati & Irri), maize, cotton and sugar-cane crops, using both the current subsidized fertilizer prices and unsubsidized fertilizer prices. The data reported in these Appendices provide some interesting insights into economics of fertilizer usage in Pakistan. These data reveal that in the case of wheat, using the average grain-nutrient ratios and the current fertilizer and wheat prices, the cost-benefit ratio declines from 3.91 at the level of 40.20-0 NPK to 1.82 at the level of 120-90-0 NPK. If we use the unsubsidized fertilizer prices, the corresponding figures of cost-benefit ratios are 3.34 and 1.56 respectively. These cost-benefit ratios show a further decline if we use the marginal

grain-nutrient ratios. The corresponding cost-benefit ratios decline to 2.27 and 0.09 at current subsidized prices and 1.94 and 0.07, if we use the unsubsidized fertilizer prices. This clearly shows that in the case of dwarf wheats, 120-90-0 NPK dosage rate is uneconomical.

Another important aspect of the economics of fertilizer use is the estimation of demand for fertilizer. Here also we are faced with a considerable amount of conceptual and methodological difficulties. The length and quality of a time series of fertilizer sales is difficult because over the period different definitions of the term 'sales' have been adopted. Moreover, it is not surprising that one should face difficulty in finding the determinents of demand from the fertilizers sales data, as over the most of the available time series, it is supply and not demand that has been the limiting factor and no data exists on the actual prices paid by the farmers including on the blackmarket. We in the Planning and Evaluation Division of the now defunct West Pakistan Agricultural Development Corporation had explored various ways of estimating fertilizer demand. Of the various functions fitted to the fertilizers sales time series, we had found that a log linear function with the time and the real price of fertilizer (i.e.actual price of fertilizer deflated by an agricultural income index) gave the best results.

In order to verify the importance of resource constraints, we examined the cross-sectional data for 32 districts for 3 years (1964-7), and fitted linear functions. Omitting the time and price variables, of the remaining five variables, we found only two variables significant, i.e. (a) acreage of land cultivated; (b) sales of fertilizers in the previous year. The other three variables were not significant although one would have expected these also to have some relevance. By fitting a further function (log linear) to the district sales, we found that changes in income were highly significant. The income elasticity of demand at 2.7 was very high. The following policy implications emerged from the study:

1. Price was not found to be a significant determinent of the level of demand but the income was.

2. The low price elasticities suggested that the removal of the fertilizer subsidy would have virtually no long-term effect.

3. In the short-term a supply of credit to the farmers should be augmented in order to minimize the effect of removal of the subsidy. This credit should have a rate of interest which is sufficient to discourage its conversion into social credit by means of fertilizer sale.

INDEPENDENT VARIABLES: Time (x'); real price of fertilizer (x^2); the acreage cultivated in the previous 12 months (x^3); average size of holdings cultivated (x^4); index of agricultural income (x^5); previous year's fertilizer sales (x^6) and irrigation index (x^7).

Mr. Azam is the Chief of Agriculture, Planning Division, Islamabad.

APPENDIX I

TABLE 1

RELATIONSHIP BETWEEN THE WHEAT AND FERTILIZER PRICES

YEAR	AVERAGE HARVEST PRICE OF WHEAT*		SALE PRICE OF N		Lbs of wheat needed to one lb of N
	One maund	One lb	110 lbs bag of urea containing 50.6 lbs N	One lb	
			(Rupees)		
1961-62	14.22	0.17	12.00	0.23	1.35
1962-63	13.61	0.17	24.00	0.47	2.76
1963-64	14.79	0.18	24.00 (July-Dec.1963)	0.47	2.61
			14.00 (Jan.-Jun.1964)	0.27	1.50
1964-65	15.00	0.18	14.00	0.27	1.50
	15.87	0.19	14.00 (July-Oct.1965)	0.27	1.42
1965-66			15.00 (Oct.'65 - Jun. '66)	0.29	1.53
1966-67	19.06	0.23	25.00	0.49	2.13
	16.00	0.20	25.00 (July-Aug.1967)	0.49	2.45
1967-68			26.00 (Sept.'67 - Jun. '68)	0.51	2.55
1968-69	18.33	0.22	26.00	0.51	2.32
1969-70	18.83	0.23	26.00	0.51	2.22
1970-71	19.44	0.24	28.50	0.56	2.33
1971-72	21.25	0.26	28.50	0.56	2.15
1972-73	23.56	0.29	28.50 (July-Sept.24, 1972)	0.56	1.93
			35.00 (Sept. 25, 1972 - Mar.29 1973)	0.69	2.37
			42.00 (March 30 - Jun. 1973)	0.83	2.86
1973-74	22.50 (Procurement Price)	0.25	42.00 (Jul.-August 9 1973)	0.83	3.32
			55.00	1.09	4.36

* *Average harvest prices of local wheat for D.I. Khan, Lyallpur and Multan Markets.*

TABLE 2

RELATIONSHIP BETWEEN THE BASMATI RICE AND FERTILIZER PRICES

YEAR	AVERAGE HARVEST PRICE OF BASMATI RICE*		SALE PRICE OF N		Lbs of rice needed to buy one lb of N
	One maund	One lb	110 lbs bag of urea containing 50.6 lbs N	One lb	
			(Rupees)		
1961-62	47.14	0.57	12.00	0.23	0.40
1962-63	47.53	0.58	24.00	0.47	0.81
1963-64	43.93	0.54	24.00	0.47	0.87
			(Jul.-Dec.1963)		
			14.00	0.27	0.50
			(Jan.-Jun.1964)		
1964-65	36.40	0.44	14.00	0.27	0.61
1965-66	34.41	0.42	14.00	0.27	0.64
			(Jul.-Oct.1965)		
			15.00	0.29	
			(Oct.'65-Jun.'66)		
1966-67	40.52	0.49	25.00	0.49	1.00
1967-68	28.12	0.34	25.00	0.49	1.44
			(July.-Aug.1967)		
			26.00	0.51	1.50
			(Sep.'67-Jun.'68)		
1968-69	27.53	0.34	26.00	0.51	1.50
1969-70	N.A.	N.A.	26.00	0.51	N.A.
1970-71	35.18	0.43	28.50	0.56	1.30
1971-72	40.51	0.49	28.50	0.56	1.14
1972-73	71.62	0.87	28.50	0.56	0.64
			(Jul.-Sep 24 '72)		
			35.00	0.69	0.70
			(Sep 25 '72-Mar 29 '73)		
			42.00	0.83	0.95
			(Mar 30-Jun.'73)		
1973-74	96.29	1.17	42.00	0.83	0.71
			(Jul.-Aug 9 '73)		
			55.00	1.09	0.93
			(Aug 10 '73 to date)		

* *Average wholesale prices from 1961-62 to 1969-70 for Lyallpur and Multan Markets, CSO.*
Harvest prices for Punjab Province from 1970-71 to 1973-74.

TABLE 3

RELATIONSHIP BETWEEN THE MAIZE AND FERTILIZER PRICES

YEAR	AVERAGE HARVEST PRICE OF MAIZE*		SALE PRICE OF N		Lbs of maize needed to buy one lb of N
	One maund	One lb	110 lbs bag of urea containing 50.6 lbs N	One lb	
			(Rupees)		
1961-62	12.37	0.15	12.00	0.23	1.53
1962-63	14.27	0.17	24.00	0.47	2.76
	15.43	0.19	24.00	0.47	2.47
			(July-Dec.1963)		
1963-64			14.00		
			(Jan.-June 1964)		
1964-65	14.61	0.18	14.00	0.27	1.50
	14.83	0.18	14.00	0.27	1.50
			(July-Oct.1965)		
			15.00	0.29	
			(Oct.'65-Jun.'66)		
1966-67	15.96	0.19	25.00	0.49	2.58
1967-68	16.33	0.20	25.00	0.49	2.45
			(July-Aug.1967)		
			26.00	0.51	2.55
			(Sept.'67 - Jun. '68)		
1968-69	15.00	0.18	26.00	0.51	2.83
1969-70	15.29	0.19	26.00	0.51	2.68
1970-71	15.97	0.19	28.50	0.56	2.95
1971-72	18.41	0.22	28.50	0.56	2.56
1972-73	23.70	0.29	28.50	0.56	1.93
			(July-Sept.24'72)		
			35.00	0.69	2.38
			(Sept 25 '72 - March 29 '73)		
			42.00	0.83	2.86
			(March 30 - June 1973)		
1973-74	25.50	0.31	42.00	0.83	2.68
			(Jul-Aug.9 '73)		
			55.00	1.07	3.52
			(Aug.10,'73 to date)		

* *Average harvest prices of maize for Multan Lyallpur and Mardan Markets.*

TABLE 4

RELATIONSHIP BETWEEN AMERICAN SEED COTTON AND FERTILIZER PRICES

YEAR	AVERAGE HARVEST PRICE OF COTTON*		SALE PRICE OF N		Lbs of cotton needed to buy one lb of N
	One maund	One lb	110 lbs bag of urea containing 50.6 lbs of N	One lb	
			(Rupees)		(Lbs)
1961-62	33.80	0.41	12.00	0.23	0.56
1962-63	29.80	0.36	24.00	0.47	1.31
1963-64	31.76	0.39	24.00	0.47	1.21
			(July-Dec.1963)		
			14.00	0.27	0.69
			(Jan.-June 1964)		
1964-65	36.62	0.45	14.00	0.27	0.60
1965-66	36.50	0.45	14.00	0.27	0.60
			(July-Oct. 1965)		
			15.00	0.29	0.64
			(Oct.'65 - Jun.'66)		
1966-67	38.25	0.47	25.00	0.49	1.04
1967-68	34.06	0.42	25.00	0.49	1.17
			(July-Aug.1967)		
			26.00	0.51	1.21
			(Sept.'67-June'68)		
1968-69	35.75	0.44	26.00	0.51	1.16
1969-70	36.00	0.44	26.00	0.51	1.16
1970-71	49.12	0.60	28.50	0.56	0.93
1971-72	46.87	0.57	28.50	0.56	0.98
1972-73	55.24	0.67	28.50	0.56	0.84
			(July-Sept.24 '72)		
			35.00	0.69	1.03
			(Sept.25'72 - March 29 '73)		
			42.00	0.83	1.24
			(March 30-June'73)		
1973-74	91.22	1.11	42.00	0.83	0.75
			(July-Aug.9,1973)		
			55.00	1.09	0.98
			(Aug.10,1973 to date)		

* *Average harvest price of seed cotton for the Multan and Rahimyar Khan markets.*

APPENDIX II

TABLE 1 COST BENEFIT RATIOS OF VARIOUS LEVELS OF FERTILIZER ON MAJOR CROPS ON THE BASIS OF AVERAGE GRAIN-NUTRIENT RATIOS

WHEAT CROP

DOSAGE (nutrient lbs)	GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION - lbs -	FERTILIZER PRICE (1974) SUBSIDIZED		FERTILIZER PRICE (UNSUBSIDIZED) *	
			Wheat Price Rs. 22.50 per maund	Wheat price Rs. 25.50 per maund	Wheat price Rs. 22.50 per maund	Wheat price Rs. 25.50 per maund
N-P-K						
40-20-0	14.1	846.0	1:3.91	1:4.49	1:3.34	1:3.84
60-60-0	10.8	1,296.0	1:3.19	1:3.66	1:2.72	1:3.13
120-60-0	8.5	1,530.0	1:2.36	1:2.71	1:2.02	1:2:31
120-90-0	7.4	1,332.0	1:1.82	1:2.09	1:1.56	1:1.78

* *The subsidy rate for the years 1973-74 has been worked out as follows:*

Total cost of Imported Fertilizer	= *Rs.141.97 crores*
Total cost of locally produced fertilizer	= *Rs. 46.26 "*
TOTAL	*Rs.188.23 "*
Subsidy cost of Imported Fertilizer	= *Rs. 48.49 "*
Subsidy cost of locally produced fertilizer	= *Rs. 2.35 "*
TOTAL SUBSIDY	*Rs. 50.84 "*
Cess. on D.H. & ESSO (-)	*Rs. 18.67 "*
Net subsidy	*Rs. 32.17 "*
Gross cost	*Rs.188.23 "*
Rate of subsidy	*17%*

TABLE 2

BASMATI RICE

DOSAGE (nutrient lbs)	GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION lbs	FERTILIZER PRICE FOR '74 (SUBSIDIZED) SUPPORT PRICE OF BASMATI RICE (1973-74) @ Rs.60.00 per maund	FERTILIZER PRICE FOR '74 (UNSUBSIDIZED) SUPPORT PRICE OF BASMATI RICE (1973-74) @ Rs.60.00 per maund
N-P-K				
69-0-0	9.4	648.6	1:6.30	1:5.38
46-40-0	9.1	782.6	1:7.16	1:6.12
69-40-0	8.9	970.1	1:6.76	1:5.77
69-60-0	8.5	1,096.5	1:6.69	1:5.72
69-60-40	7.8	1,318.2	1:6.74	1:5.76
92-60-40	7.4	1,420.8	1:6.18	1:5.28

TABLE 3

IRRI RICE

DOSAGE (nutrient lbs)	GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION lbs	FERTILIZER PRICE IN '74 (SUBSIDIZED) AVERAGE PROCUREMENT PRICE OF IRRI VARIETIES @ Rs.25.00 per maund	FERTILIZER PRICE (UNSUBSIDIZED) AVERAGE PROCUREMENT PRICE OF IRRI VARIETIES @ Rs.25.00 per maund
N-P-K				
50-0-0	16.1	805.0	1:4.41	1:3.79
100-0-0	14.1	1,410.0	1:3.88	1:3.32
100-50-0	11.6	1,740.0	1:3.58	1:3.06
150-50-0	10.9	2,180.0	1:3.26	1:2.79
150-100-0	11.2	2,800.0	1:3.54	1:3.02

TABLE 4

MAIZE

DOSAGE (nutrient lbs)	GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION lbs	FERTILIZER PRICE FOR '74 (SUBSIDIZED) HARVEST PRICE OF MAIZE (1973-74) @ Rs.25.50 per maund	FERTILIZER PRICE FOR '74 (UNSUBSIDIZED) HARVEST PRICE OF MAIZE (1973-74) @ Rs.25.90 per maund
N-P-K				
40-20-0	12.2	732.0	1:3.88	1:3.32
80-40-0	8.6	1,032.0	1:2.74	1:2.34
120-60-0	6.7	1,206.0	1:2.13	1:1.82
160-00-0	6.2	1,488.0	1:1.97	1:1.69
200-100-0	5.9	1,770.0	1:1.88	1:1.61

TABLE 5

COTTON

DOSAGE (nutrient lbs)	SEED COTTON NUTRIENT RATIO	ADDITIONAL PRODUCTION in lbs	FERTILIZER PRICE 1974 (SUBSIDIZED) HARVEST PRICE OF SEED COTTON (1973-74) @ Rs.91.22 per maund	FERTILIZER PRICE '74(UNSUBSIDIZED) HARVEST PRICE OF SEED COTTON (1973-74) @ Rs.91.22 per maund
N-P-K				
50-0-0	5.4	270.0	1:5.50	1:4.70
50-20-0	4.8	336.0	1:5.38	1:4.60
50-40-0	4.4	396.0	1:5.23	1:4.47
75-40-0	4.9	563.5	1:5.62	1:4.80
75-40-30	4.3	614.9	1:5.30	1:4.53

TABLE 6

SUGAR-CANE

DOSAGE (nutrient lbs)	CANE/ NUTRIENT RATIO	ADDITIONAL PRODUCTION in lbs	FERTILIZER PRICE 1974 (SUBSIDIZED) AVERAGE SUPPORT PRICE OF SUGAR-CANE @ Rs. 4.22 per maund	FERTILIZER PRICE '74 (UNSUBSIDIZED) AVERAGE SUPPORT PRICE OF SUGAR-CANE @ Rs. 4.22 per maund
N-P-K				
80-40-0	152.9	223.0	1:8.06	1:6.89
120-40-0	160.4	311.9	1:8.21	1:7.01
120-80-0	146.9	357.1	1:7.93	1:6.78
120-80-40	138.8	404.9	1:8.01	1:6.85
120-80-120	124.7	485.0	1:7.86	1:6.72
160-80-120	125.9	550.9	1:7.67	1:6.55

APPENDIX III

COST BENEFIT RATIOS OF VARIOUS LEVELS OF FERTILIZER USE ON MAJOR CROP ON BASIS OF MARGINAL GRAIN - NUTRIENT RATIOS

TABLE 1

WHEAT

DOSAGE	INCREMENTAL YIELD	GRAIN/ NUTRIENT RATIO	MARGINAL PRODUCTION	ADDITIONAL GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION	FERTILIZER PRICE 1974 (SUBSIDIZED)		FERTILIZER PRICE (UNSUBSIDIZED)	
						Wheat price Rs. 22.50 per maund	Wheat price Rs. 25.50 per maund	Wheat price Rs. 22.50 per maund	Wheat price Rs. 25.50 per maund
N-P-K	mds/acre		mds/acre		lbs				
40-20-0	10.3	14.1							
60-60-0	15.9	10.8	5.6	7.7	924.0	1:2.27	1:2.61	1:1.94	1:2.23
120-60-0	18.8	8.5	2.9	4.0	720.0	1:1.11	1:1.27	1:0.95	1:1.09
120-90-0	18.9	7.4	0.1	0.3	63.0	1:0.09	1:1.10	1:0.07	1:0.08

TABLE 2

BASMATI RICE

DOSAGE	INCREMENTAL YIELD	GRAIN NUTRIENT RATIO	MARGINAL PRODUCTION	MARGINAL GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION	FERTILIZER PRICE 1974 (SUBSIDIZED)	FERTILIZER PRICE (UNSUBSIDIZED)
N-P-K	mds/acre		mds/acre		lbs.		
69-0-0	7.9	9.4					
46-40-0	9.5	9.1	1.6	7.7	662.2	1:6.06	1:5.18
69-40-0	11.8	8.9	2.3	8.2	893.8	1:6.23	1:5.32
69-60-0	13.4	8.5	1.6	6.6	851.4	1:5.20	1:4.44
69-60-40	16.1	7.8	2.7	5.6	946.4	1:4.84	1:4.13
92-60-40	17.3	7.4	1.2	4.3	825.6	1:3.59	1:3.07

TABLE 3

IRRI RICE

DOSAGE	INCREMENTAL YIELD	GRAIN NUTRIENT RATIO	MARGINAL PRODUCTION	MARGINAL GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION	FERTILIZER PRICE 1974 (SUBSIDIZED)	FERTILIZER PRICE (UNSUBSIDIZED)
N-P-K	mds/acre		mds/acre		lbs		
50-0-0	9.8	16.1					
100-0-0	17.2	14.1	7.4	12.2	1,220.0	1:3.36	1:2.87
100-50-0	21.2	11.6	4.0	6.6	990.0	1:2.03	1:1.74
150-50-0	26.6	10.9	5.4	8.6	1,720.0	1:2.57	1:2.20
150-100-0	34.0	11.2	7.4	12.2	3,050.0	1:3.85	1:3.29

TABLE 4

MAIZE

DOSAGE	INCREMENTAL YIELD	GRAIN NUTRIENT RATIO	MARGINAL PRODUCTION	MARGINAL GRAIN NUTRIENT RATIO	ADDITIONAL PRODUCTION	FERTILIZER PRICE 1974 (SUBSIDIZED)	FERTILIZER PRICE (UNSUBSIDIZED)
N-P-K	mds/acre		mds/acre		lbs		
40-20-0	8.9	12.2					
80-40-0	12.7	8.6	3.8	5.2	624.0	1:1.66	1:1.42
120-60-0	14.8	6.7	2.1	2.9	522.0	1:0.92	1:0.79
160-80-0	18.4	6.2	3.6	4.9	1,176.0	1:1.56	1:1.33
200-100-0	21.5	5.9	3.1	4.3	1,290.0	1:1.37	1:1.17

TABLE 5

COTTON

DOSAGE	INCREMENTAL YIELD	SEED COTTON NUTRIENT RATIO	MARGINAL PRODUCTION	MARGINAL SEED COTTON NUTRIENT RATIO	ADDITIONAL PRODUCTION	FERTILIZER PRICE 1974 (SUBSIDIZED)	FERTILIZER PRICE (UNSUBSIDIZED)
N-P-K	mds/acre		mds/acre		lbs		
50-0-0	3.3	5.4	0.8				
50-20-0	4.1	4.8	0.8	3.3	231.0	1:3.70	1:3.16
50-40-0	4.8	4.4	0.7	2.9	261.0	1:3.44	1:2.94
75-40-0	6.8	4.9	2.0	6.6	759.0	1:7.57	1:6.47
75-40-0	7.5	4.3	0.7	1.9	275.5	1:2.38	1:2.03

TABLE 6

SUGAR-CANE

DOSAGE	INCREMENTAL YIELD	CANE NUTRIENT RATIO	MARGINAL PRODUCTION	MARGINAL CANE NUTRIENT RATIOS	ADDITIONAL PRODUCTION	FERTILIZER PRICE 1974 (SUBSIDIZED)	FERTILIZER PRICE (UNSUBSIDIZED)
N-P-K	mds/acre		mds/acre		lbs		
80-40-0	223	152.9					
120-40-0	312	160.4	89	183.1	356.10	1:9.37	1:8.01
120-80-0	357	146.9	45	92.6	225.11	1:5.00	1:4.27
120-80-40	405	138.8	48	98.7	287.93	1:5.70	1:4.87
120-80-120	485	124.7	80	82.3	320.12	1:5.20	1:4.45
160-80-120	551	125.9	66	135.7	593.80	1:8.26	1:7.06

VI. Promoting Fertilizer Use

The Role of Credit in Promoting Fertilizer Use in Turkey

Mr. Kemâl Kaptan

In Turkey, 64% of the population presently lives in the rural areas earning their livelihood from agriculture. In 1972, over 65% of the active population lived in the same sector. Although the rural population is decreasing rapidly and the urban population is increasing, the ratio of agricultural income is decreasing in the national economy. In spite of this situation 72% of the total value of exported Turkish goods in 1972 was from crops.*

During the first two Five Year Development Plan Periods, in spite of important developments in the other sectors, agricultural development was less than expected. This situation always has a negative effect on the general economy.

At the present time, Turkish crop land includes marginal soils. For this reason, it is not possible to increase crop production by means of horizontal development. The yields are low in Turkey. It is possible to increase the yields or further vertical development in a short time by providing modern inputs to the farmers who generally do not have enough operational capital.

AGRICULTURAL CREDIT AND FERTILIZER USAGE

Credit is an effective factor in the realization of agricultural development. Credit allows the possibility of using modern inputs. Fertilizer is an important input for increasing yields and improving the quality of crops. Turkish soils are in dire need of fertilizer, but Turkish farmers often lack operational capital for their farms. However, it is possible to increase fertilizer consumption by providing enough credit through a good agricultural credit organization.

* *The Third Five Year Development Plan.*

FERTILIZER PRODUCTION AND USAGE

Fertilizer production quantities and usage and their indexes are shown in table 1. According to these figures the quantities of fertilizer produced increased from 325,000 tons in 1963 to 1,431,068 tons in 1972, while the quantities of fertilizer consumed increased from 426,421 tons to 3,284,340 tons. These figures reflect the effects of promotion on fertilizer production and usage. This is a satisfactory situation, but it is definitely not enough for Turkey. In the future, in order to provide for the demand of agricultural crops which will increase gradually, Turkey has to rapidly increase her fertilizer consumption in a short time.

FERTILIZER CREDIT

In Turkey, the main responsibility for the procurement and distribution of fertilizer has been given to the Agricultural Supply Organization. The procurement and distribution of fertilizer for sugar-beet producers alone is handled by the Turkish Sugar Corporation. According to Government Decree No. 6-951, the Agricultural Supply Organization meets its credit needs from the Bank of Agriculture for all fertilizer purchases. Either it provides the fertilizer credit to the farmer directly or through the Agricultural Credit Co-operatives indirectly. The fertilizer credits which are directly given to the farmer by the Bank of Agriculture and are given to the farmer also by means of the Agricultural Credit. The Sugar Corporation provides fertilizer credits from its own financial resources when needed. The Ministry of Agriculture, the Agricultural Supply Organization, the Bank of Agriculture and the Fertilizer Producers' Firms come together and determine the principles of fertilizer credit. Co-operatives are shown in table 2. The Turkish Sugar Corporation gives enough fertilizer to the all sugar-beet farmers as an advance and collects it back when the farmer is paid for his annual harvest. It is possible to accept this as a fertilizer credit. The fertilizer credits which were given by the three public organizations during 1963-72 are shown in table 3. The most important reason for this rapid rise of fertilizer usage is the increase of fertilizer credits, but during 1970-71 they had not paid enough attention to the repayment of the credits which remained uncollected from the farmers. This situation is shown in table 4.

Table 5 shows the fertilizer rates and the total fertilizer financial values by years. In the future, fertilizer credits will increase parallel to the fertilizer consumption. Table 6 shows the projected fertilizer credit needs during 1973-82. According to this table, credit needs were 2,001,899,000 Turkish liras in 1973 and will increase to an

estimated 3,714,941,000 TL in 1982.

MEASURES FOR PROVIDING THE FERTILIZER CREDIT NEEDS IN THE FUTURE

1. 80-90% of the fertilizer finance needs were provided by the public sector during 1963-72,* as were most of the fertilizer credits. Up to now, a large portion of the fertilizer credit has not been paid by the farmers. For this reason, credit and financing by the public sector is decreasing. The Government will have to take the necessary steps to increase the credit resources and repay the fertilizer credits for farmers who have not been paying.

2. Government also has to encourage the further participation of the private sector. For example, agricultural credit co-operatives may accept deposits from its members and other people, thereby increasing their own finance possibilities. They may in turn, use these amounts for fertilizer financing and credit for their members.

3. Fertilizer credit must first be given to farmers who have not been using fertilizer or are using very little - particularly in the under-developed parts of the country.

4. Sales prices without a credit basis must increase especially in the developed regions. Generally the fertilizer credit needs of these developed farmers should be provided by the private sector.

5. The government must continuously take steps to repay the farmers' fertilizer credits.

* *State Planning Organization*

Dr. Kaptan is Head of the Planning and Budget Department, General Directorate of Agricultural Affairs.

TABLE 1

FERTILIZER PRODUCTION AND USAGE - QUANTITIES AND THEIR INDEXES FOR 1963-70 IN TURKEY

Unit Tons

YEAR	PRODUCTION	INDEX	RATIO OF PRODUCTION QUANTITIES TO USAGE QUANTITIES %	USAGE QUANTITIES	INDEX
1963	325,000	100	76	426,421	100
1964	317,000	97	59	532,200	124
1965	379,068	116	46	812,912	190
1966	379,601	116	37	1,025,756	240
1967	361,057	111	23	1,535,278	360
1968	463,298	142	21	2,116,640	496
1969	523,263	161	21	2,448,422	574
1970	785,070	241	35	2,215,226	519
1971	977,212	300	30	2,536,539	594
1972	1,431,068	440	43	3,284,340	770
AVERAGE	594,163	182	39	1,693,373	396

SOURCE: Ministry of Agriculture

TABLE 2

BANK OF AGRICULTURE FERTILIZER CREDIT TO FARMERS FOR 1963-70*

YEAR	DIRECTLY TO FARMER	INDEX	BY MEANS OF AGRICULTURAL CREDIT CO-OPERATIVES	INDEX	TOTAL	INDEX
1963	17,273,493	100	20,596,527	100	37,870,020	100
1964	27,942,814	161	35,164,978	170	63,107,792	166
1965	48,595,060	281	71,006,418	344	119,601,478	315
1966	65,018,197	376	96,680,653	469	161,698,850	426
1967	122,253,348	707	187,056,635	908	309,309,983	816
1968	165,211,268	956	255,598,565	1,240	420,809,833	1,111
1969	195,617,806	1,132	329,928,483	1,601	525,546,889	1,387
1970	110,466,442	639	366,637,286	1,780	477,103,728	1,259
1971	55,843,688	323	339,334,726	1,647	393,178,414	1,043
1972	103,881,152	601	420,383,711	2,041	524,269,865	1,384
AVERAGE	91,210,326	527	212,238,798	1,030	303,249,185	800

SOURCE: Bank of Agriculture

* *All figures in table 2-6 are in Turkish lira.*

TABLE 3 *GIVEN FERTILIZER CREDIT LOANED TO FARMERS BY THE PUBLIC SECTOR FOR 1963-70 (1,2, 3)*

YEAR	BANK OF AGRICULTURE	AGRICULTURAL SUPPLY ORGANIZATION	TURKISH SUGAR CORPORATION	TOTAL
1963	37,870,020	68,279,353	50,843,584	156,992,957
1964	63,107,702	111,741,468	76,823,840	251,673,010
1965	119,601,478	217,472,766	75,570,431	412,644,675
1966	161,698,850	187,700,861	89,767,767	439,167,478
1967	309,309,983	308,639,368	94,790,650	712,740,001
1968	420,809,833	357,322,078	86,285,784	864,417,695
1969	525,546,889	286,601,743	90,389,827	902,538,459
1970	477,103,728	179,290,907	112,793,600	769,188,235
1971	393,178,414	367,177,178	100,812,724	1,862,168,316
1972	524,264,864	455,541,368	134,992,888	1,114,799,120
AVERAGE	303,249,176	255,976,709	91,407,109	650,632,994

SOURCE: *(1) Bank of Agriculture*

(2) Agricultural Supply Organization

(3) Turkish Sugar Corporation

TABLE 4

END OF THE YEAR DEBTS REGARDING FERTILIZER CREDITS FOR 1963-72

YEAR	BANK OF AGRICULTURE	INDEX	AGRICULTURAL CREDIT CO-OPERATIVES	INDEX	AGRICULTURAL SUPPLY ORGANIZATION	INDEX	TOTAL	INDEX
1963	23,000,000	100	20,596,527	100	95,860,696	100	139,457,344	100
1964	37,025,276	160	23,477,983	113	138,130,830	144	198,634,069	142
1965	64,702,152	281	42,351,756	205	192,177,730	200	299,231,638	214
1966	92,111,151	400	48,352,106	234	307,952,573	321	448,415,830	321
1967	178,653,600	776	93,784,711	455	402,102,936	419	674,541,247	483
1968	272,318,629	1,183	243,896,734	1,184	278,028,714	290	794,244,137	569
1969	407,908,005	1,773	351,112,409	1,704	307,638,515	320	1,066,658,930	764
1970	456,227,584	1,983	377,410,460	1,832	480,408,293	501	1,314,046,337	942
1971	399,215,991	1,735	350,763,178	1,703	430,240,962	469	1,200,221,131	860
1972	437,380,795	1,901	540,144,350	2,622	933,357,997	973	1,910,883,142	1,370
AVERAGE	236,854,430	1,029	209,189,025	1,015	358,589,924	373	804,633,379	576

SOURCE: Bank of Agriculture

TABLE 5 *FERTILIZER FINANCING AND PUBLIC SECTOR CREDIT FOR 1963-73*

YEAR	FERTILIZER FINANCING	PUBLIC SECTOR CREDIT	RATE OF PUBLIC SECTOR CREDIT TO FERTILIZER FINANCING (%)
1963	223,167,240	156,992,957	70
1964	299,956,000	251,673,010	83
1965	449,980,260	412,644,675	91
1966	530,336,800	439,167,478	82
1967	746,777,280	712,740,001	95
1968	989,815,890	864,417,695	87
1969	1,163,004,040	902,588,459	77
1970	1,318,955,540	769,188,235	58
1971	1,428,300,880	862,168,316	60
1972	1,895,957,470	1,114,799,120	58
AVERAGE	904,625,140	648,632,994	71

SOURCE: Acquired by calculations of the quantities of fertilizer usage and their prices

TABLE 6 *FERTILIZER CREDIT NEEDS FOR 1973-82*

YEAR	TOTAL FERTILIZER NEEDS IN TONS (1)	FINANCE NEEDS (2)	CREDIT NEEDS (3)
1973	4,403,700	2,819,576	2,001,899
1974	4,826,600	3,091,856	2,195,218
1975	5,251,700	3,366,472	2,390,195
1976	5,676,400	3,640,880	2,585,025
1977	6,173,900	3,964,056	2,814,480
1978	6,531,400	4,189,600	2,974,616
1979	6,940,000	4,440,600	3,152,826
1980	7,347,500	4,710,752	3,344,634
1981	7,755,900	4,971,272	3,529,603
1982	8,164,500	5,232,312	3,714,951

SOURCE: (1) *State Planning Organization*
(2) *Calculated according to the present prices*
(3) *Calculated according to the rate of 71%, which is the average rate*

The Role of Extension & Education in Promoting Fertilizer Use in Iran

Mr. Mohammad Taghi Jebraili

AGRICULTURAL EXTENSION IN IRAN

It is not by chance that 52% of the farmers in Iran today are planting improved wheat seed; that smut in wheat has been eradicated in 4 years time; that the use of commercial fertilizers has risen from 3,000 tons in 1956 to 273,000 tons in 1969; that the use of insecticides has more than quadrupled in 4 years and that the grape mildew is now generally under control.

These facts do, however, indicate the effect and influence of a small body of dedicated workers who have experienced the pleasure which comes from helping their fellow countrymen to help themselves by adopting recommended practices such as the use of good seed, fertilizer, pest control methods, cultural practices and the proper use of natural resources as means for better production and better living.

During 1351 (1972), extension agents guided over 30,000 farmers through 64,000 demonstrations of the methods of improved fertilizer cultural practices through the use of natural resources.

Agricultural extension in Iran was launched in 1953 with an orientation session in the Ministry of Agriculture to study the philosophy of extension and how it would fit into the Ministry programme of agricultural improvement. Today, this service has a staff of 130 trained workers at the headquarters in Tehran; 210 supervisory technical and administrative personnel in 21 ostan and farmandari headquarters and 8,000 agents at bakhsh and village levels who work intensively in over 5,000 villages and make some contribution in 5,000 more villages.

At National Headquarters, the Extension Service consists of six major divisions in addition to the Director and Assistant Director:

1. The Administrative Services Division which directs the work of budgeting, personnel, property management, payroll, travel, communications and records.

2. An Agricultural Division, consisting of a supervisor and 10 Subject Matter Specialists who supervise and direct agricultural programmes in 21 ostans and farmandaris.

3. A Rural Youth Division with a national supervisor and an assistant who directs a programme implemented by 21 Ostan Youth Specialists with 510 clubs and 4,617 members.

4. A Training and Evaluation Division which organizes and directs all preservice and inservice training of personnel and conducts field studies and analyzes reports for programme evaluation.

5. An Extension Information Division which prepares visual aid material; directs an audio visual programme; assists specialists in the preparation of bulletins, circulars and posters and prepares news releases and radio programmes.

6. The Extension and Development Corps, being the third Revolutionary Corps of Iran, was formed through a decree which I issued on the 1st Mehr 1343 (1964). The objective of the Corps was to fulfill a programme which was initiated by the land reform movement.

I have often mentioned the fact that the work of modernizing our country can be really successful only if it starts at the grassroots of our society. Thus, the work of extension and development must begin in the villages and small towns. This task was entrusted to the members of the Extension and Development Corps. Their duties are defined in the law on the formation of the Corps.

Every member of the Extension and Development Corps is required to conduct a training programme in agriculture and stockbreeding and to try to raise the villagers' general level of knowledge. To do this, every corpsman sees that the villagers, using seeds supplied by the Ministry of Agriculture, plant demonstration fields of at least 1,000 square metres. These fields demonstrate the best ways of preparing the soil, sowing, harvesting, the use of the best seeds, chemical fertilizers, irrigation methods and pest control measures.

Finally, to instruct young villagers in the problems of social life, each corpsman must establish a club consisting of at least 15 young farmers. The youngsters learn by carrying out selected agricultural, social and community projects. As an aid to the corpsmen, the ex-

tension and Development Corps has prepared a handbook which outlines procedures necessary to effectively establish the clubs.

Of course, compared with what must be done in the future, that which has been achieved so far is little more than a start. The work which the members of the Extension and Development Corps are doing is most valuable, but the full programme is vast and arduous. Their mission cannot be considered as completed until all of our villagers are comparable with the most up-to-date villages of the developed countries, benefitting to the fullest extent from such amenities as roads, electricity, water and health establishments, schools, sports facilities, libraries, cinemas, co-operatives, cultural and social organizations and social insurance which are essential for a progressive way of life today, and until they are able to make the fullest use of their farms by means of the latest technical and scientific methods.

The major phases of work emphasized in the extension programme have been: (1) organization; (2) training; and (3) farmer education through meetings, demonstrations and farm visits. The programme has been projected through the principal divisions of Training, Agriculture, Agricultural Information, Home Extension and Rural Youth.

ORGANIZATION

The Agricultural Extension Service is now an established division of the Ministry of Agriculture by act of Majelis (Parliament) and constitutes the connecting link between the Ministry and the farmers of the country for disseminating information on better farming methods and for getting specific information on the major problems of farmers.

To fulfill this function the Extension Service is organized at:

1. The Headquarters Office with five principal operating divisions consisting of 13 administrators and supervisors, and 20 technical personnel;

2. 21 Ostan Organizations with 21 supervisors, 21 administrative workers, 84 specialists and 600 agricultural extension agents; and

3. the organization of Shahrestan (county) offices are presently being set up and will be directed by a Shahrestan extension supervisory agent, who will direct the work of 10 to 30 extension agents.

Training of extension personnel has been and will continue to be of major importance for some time. Although workers are now placed in posi-

tions, they are actually continuing "on the job" training to become more proficient.

THE KARAJ AGRICULTURAL EXTENSION TRAINING CENTRE

In execution of His Imperial Majesty's orders, and in accordance with the respective Act ratified on the 28th Dey, 1343(1964)which calls for the formation of the Extension and Development Corps - the eighth principle of the Revolution - the first training term of the Corps started on 15th Ordibehesht 1344 (1965), and the military, technical and special training programmes were implemented at the Karaj Agricultural Extension Training Centre.

The Karaj Training Centre is located in the Shahdasht Plain, 15 km. south-west of Karaj across from the Tehran-Karaj highway. During the formation process of the Corps, this centre was accommodated to meet the technical and military training needs of the time. Later, the technical and administrative units and public facilities including dormitories and classrooms, were expanded and at present the centre consists of the following units: animal husbandry, poultry, field crops, gardening, plant pests and diseases control, farm machinery, demonstration fields, laboratories, trainees and instructors' lounge.

The centre is a unique institution where co-ordinated military and agricultural training is given. It is often visited by Iranian and foreign students and officials. Extension corpsmen undergo a total of 345 hours of class and workshop training in agriculture, co-operative and rural affairs, housing and development and economics. Having learned the improved methods of agriculture, proper use of farm machinery, etc. and after receiving appropriate military training, they will be sent to villages throughout the country to guide farmers and help develop the community to which they are assigned.

ACTIVE ROLE OF EXTENSION AND DEVELOPMENT CORPSMEN IN THE CROP INCREASE PROJECTS

According to His Imperial Majesty's order, with regard to the more efficient use of natural resources and crop increase per unit of land, the Ministry of Agriculture has made full use of the corpsmen's services. Their function is not limited to extension work but rather a major part of their time is spent on various crop increase projects through which modern methods of farming are introduced. The Ministry of Agriculture, with its present staff, would hardly be able to carry out these projects without having access to the energetic and active force

of the corpsmen. These activities include crop increase projects on wheat, rice, forage crops and cotton.

The corpsmen are actively engaged in all stages of the farming operations including signing contracts with farmers and registering the data and maintaining records.

The objective of the agricultural phase of the Fourth Development Plan is to compensate the shortcomings of crop production. To meet the demands of the population increase in proportion with the need for extra food and in order to make fullest use of natural potentials, the Ministry of Agriculture has drawn-up the above projects which are carried out by corpsmen and the private sector. They are short-term projects which result in production increases within a single crop year.

1. *Crop Increase Project on Wheat*

This project was drawn and carried out in eight ostans at the end of the Third Plan.

The project area was limited in proportion to the total land under wheat cultivation, but the results were so promising that the project constituted a major item of the Fourth Plan which called for importing the Mexican wheat variety. This seed, being the initial start of the Green Revolution in many countries, produced a crop of six tons per hectare in certain areas and three to four tons in other tropical and temperate regions of the country and thus registered a turning point in the history of wheat cultivation in Iran. The growing demand for the Mexican variety of wheat resulted in the importation of large quantities of the seed which was distributed among wheat growers in the second and third year of the Plan.

During the year 1349 (1970) a total of 70,000 hectares were sown with the Mexican variety. In 1348 (1969), the Ministry of Agriculture imported another variety of wheat seed, Bezostaya, which was adaptable to colder climates. The crop was satisfactory and, at present, 20,000 hectares are sown with this seed. Nevertheless, the native varieties of wheat are not overlooked and a total of 10,000 hectares of land are under cultivation with varieties of native seeds.

2. *Crop Increase Project on Rice*

This project was initiated on 30,000 hectares at the start of the Fourth Plan in the Gilan and Mazandaran ostans. Approximately 170,000 rice growers from 374 villages participated in the project and took benefit of credit in kind (seed and fertilizers) and cash. In 1348 (1969), the project covered 57,000 hectares with a total participation of 35,000 rice growers. This year 125,000 hectares of land were utilized

with a total participation of 86,000 rice growers from 1,639 villages. The crop amounted to 1,000,000 tons - an average of 5,250 kgs. per hectare of short-stem variety and 3,500 kgs. per hectare of Sadri variety.

3. *Crop Increase Project on Forage Crops*

This project was carried out on 6,310 hectares in 1348 (1969) and 8,540 hectares of land in 1349 (1970). Improved varieties of seed, chemical fertilizers and cash credit was offered to the rice growers. Thus an additional of 56,000 tons of dry crop was produced. A total of 2,395 tons of fertilizers, 325 tons of alfalfa, hybrid corn and other varieties of seed were also distributed.

4. *Crop Increase Project on Cotton*

This project was started in 1348 (1969) on 21,320 hectares of land in the Khorasan, Gorgan, Mazandaran, Dashte Moghan, Fars and the Central ostans. 586,700 kgs. of improved seeds and 2,141,931 kgs. of chemical fertilizers were distributed among the participating cotton growers. A 500 hectare cotton field was established with the use of various machinery and 108 demonstration fields of one to two hectares were put in during a joint venture of Iranian and French specialists.

In 1349 (1969), the project was expanded to cover a total area of 45,000 hectares. 107,100 kgs. of improved seeds and 5,458,777 kgs. of chemical fertilizers were distributed. The project brought the national cotton crop to a record of over 155,000 tons of ginned crop which supplied not only the internal need but was a major item of foreign exchange gains.

The excellent results of the crop increase projects, manifesting the basis of the Principles of Iran's Revolution, were obtained through the efficient efforts of the Extension and Development Corpsmen and agents. Farmers were given a chance to actively participate in various technical services and programmes of the Ministry of Agriculture and thus reap the benefits of technical aids and credits.

At present, a total of 845 corpsmen (high school and university graduates) are actively involved in the crop increase projects throughout the country.

SOME INFORMATION FOR THE USE OF FERTILIZERS IN IRAN

Every hectare of irrigated, cultivated land loses annually an average of about 600 kgs. of nutrients to the various crops. In other words: the fertility of agricultural lands is being steadily depleted, year by year, as a result of the crops and the cultivation practices used by the farmers.

One hectare of agricultural land, to the depth of 20 cm., weighs approximately 2,500-3,000 tons. This mass of soil contains 0.6-1.2 tons of nitrogen, 6-12 tons of potash and 1.50-9 tons of phosphate. If we subtract 600 kgs. of nutrients every year and do not return anything to the soil in the form of fertilizer or any other material, it is easily to be seen that the rate of nutrient depletion will be very rapid.

Modern agricultural practices and the use of organic manure only, are fairly useful in contributing to the conservation of the soil's nutritional capacity, but they are not sufficient in themselves. Only about one-half of the nutrients taken up from the soil by a crop system are returned to it organically. For example: the feeding of one cow or horse necessitates the production of forage from one hectare of land per year. This means that about 325 kgs. of nutrients are removed per hectare of soil for this purpose. Even if all the organic manure produced by the animal is returned to this same hectare, this will not cover the depletion since it contains only about 200 kgs. of nutrients, i.e. only two-thirds of the nutrients will be returned to the soil. This is, of course, quite easily understood in view of the fact that the animal digests and assimilates some of the food it ingests, and these nutrients are no longer available for return to the soil.

From such a simple calculation, we can conclude that if all agricultural lands were used for raising stock, and the manure produced by the animals was re-cycled into the soil as fertilizer, we should still find our soils becoming poorer and poorer by the year. This is unacceptable under the world's present conditions, where an expanding population which must be adequately fed, demands that we preserve the fertility of our soils at the highest possible level.

We must do this in order to produce more and more food every day, and this aim cannot possibly be achieved without the aid and proper use of chemical fertilizers. It is this vital need which has seen the utilization of chemical fertilizers double in the last six years, and the rate is still rising.

Even if figures for Communist China are not included, we find that the world's use of chemical fertilizers exceeds 200 million tons per annum. Scientists have already forecast the trebling of chemical fertilizer use by 1980.

Of the Asian countries, Japan shows by far the most progress in fertilizer use, consuming about 8 million tons of chemical fertilizer per year. Of this quantity, 2 million tons are used in rice growing alone.

The figures for the productive capacity of the various chemical fertilizers, under agricultural conditions of all types, are quite interesting in themselves.

For 4 kg. of nitrogen (N), productive capacity, on the average, is considered to be about 18 kgs. of grain, 90 kgs. of potatoes, 87 kgs. of sugar-beets, 200 kgs. of beetroots or 22 kgs. of dried grass fodder per hectare.

One kg. of phosphate (P_2O_5) can produce 6.3 kgs. of grains, 46 kgs. of potatoes, 51 kgs. of sugar-beets, 125 kgs. of beetroots or 26.3 kgs. of dried grass fodder.

Research of the world's agricultural scientists, aimed at raising agricultural production in all branches of the farming effort, can be considered complete only if they include the rational utilization of chemical fertilizers. This statement appplies to all fields of agricultural research, as the following example will demonstrate.

Mexican "hybrid" wheat, or the Tai Chung variety of rice, are of great agricultural importance only because they are capable of utilizing chemical fertilizers in order to give commensureately higher yields. It is quite well-known that the use of these high quality varieties without chemical fertilizers will not give the significantly higher yields to justify their use in prepference to the ordinary varieties.

THE PRESENT STATE OF CHEMICAL FERTILIZER USE IN IRAN

The use of chemical fertilizers rose steeply after completion of the first phase of the Land Reform and the Extension Corps assignment to the villages in 1965. Results of planning for those years also show a considerable rise in agricultural production, and demonstrate that the use of chemical fertilizers more than tripled from 1964 to 1968.

THE USE OF VARIOUS TYPES OF CHEMICAL FERTILIZERS

The use of urea fertilizer has grown very rapidly, relative to the other fertilizers used. There are several reasons for this rapid rise:

1. The effect of nitrogen upon plants is very considerable.

2. Nitrogen is not usually fixed by the soils. This combination of circumstances means that our soils usually lack sufficient nitrogen, and that the response of crops to nitrogenous fertilizers is very good. Only in certain locations, especially in land cleared of forests, is there little or no positive response to applied nitrogenous fertilizer.

3. Urea is popular with farmers and instructors alike both from economic and technical points of view. Of the nitrogenous fertilizers, it contains the highest concentration of nitrogen, and it is well suited to the soils of Iran chemically, generally having quite positive effects upon them.

The second fertilizer whose use is growing very rapidly is ammonium phosphate. The reasons for this growth are:

1. Iranian soils are generally deficient in phosphates.

2. Soils containing much calcium prevent the intake of phosphate by plants, by fixing it as Ca-phosphate complexes. Economically speaking, ammonium phosphate is preferred because it contains a rich source of nitrogen (ammonium) as well as phosphate. This makes it a good "combined" fertilizer, thus reducing costs.

After the two leaders in the field, one finds triple superphosphate and the other mixed and compound fertilizers in frequent use.

If the import of these mixed and compound fertilizers were allowed to proceed freely, it is very likely that their use would soon surpass that of ammonium phosphate, of superphosphate and perhaps even that of urea. But the price of combined fertilizers is rather high, and since our government's policy is directed towards protecting the products of the Shiraz fertilizer plant, there is a definite prohibition on the use of combined fertilizers for most agricultural crops in Iran. Their use is allowed only in cases where it is proved to be vital to the welfare and yield of the particular crop in question.

Our country's soils are rich in potassium so that there is not much importance attached to the use of potassic fertilizers, except in special cases. One of these is the growing of potatoes. Again, there are some regions in the north of Iran where potassic fertilizers are recommended for the prevention of "lodging" in cereal crops, especially rice. Potassic fertilizers are also specially recommended for use in fruit orchards planted on light soils. In these cases, potassium sulphate is the fertilizer most generally used.

Ammonium sulphate is used almost exclusively in tea growing. From the technical point of view, and considering its fine adaption to Iranian soils, this is a good fertilizer, but its relatively high price prevents it from being more widely used.

THE USE OF CHEMICAL FERTILIZERS FOR VARIOUS AGRICULTURAL CROPS

The distribution of fertilizers used in growing the various food crops during the years 1967-69, divided according to the three main nutrient elements of which they are constituted, are as is usual in fertilizer practice, N (nitrogen), P_2O_5 (phosphorus) and K_2O (potassium). The latter two are presented as oxides.

Farmers use more fertilizers in the growing of rice than in all other crops. This is the situation, statistically speaking, in spite of the fact that the amount of fertilizer used per unit area of rice is smaller than that used in some of the other crops, such as sugar-beets or vegetables.

The reasons why more fertilizer is used on rice:

1. The climatic conditions under which rice is grown are especially suited to the use of fertilizer.

2. Rice is grown under irrigation and thus there never arises the problem of limited use of fertilizer under the conditions of water stress.

3. The most important reason for fertilizer use in rice, however, is the following: fertilizer used in combination with irrigation gives the best results in the most economical manner. The effects of both factors seem to be synergistic.

4. Rice is a comparatively profitable crop for Iranian farmers. The purchasing power of rice farmers is thus comparatively higher than that of the others, and the realization that fertilizing pays off in the form of higher income from the higher yields obtained, brings about the intensified use of chemical fertilizers by rice farmers.

After rice, the use of fertilizers in wheat growing is greater than in other crops. This is interesting because the amount of fertilizer applied per unit area of crop grown is also quite small, and the rise in yield as a result of fertilizer application is also not that great. The reason why the total use of fertilizer in wheat is so high lies in the fact that wheat is grown on such large areas. With the planning of further areas of wheat growing, and especially with the introduction of the

Mexican hybrid wheat (whose use is economically justified only if fertilizer is applied), a further jump in chemical fertilizer use is forecast for the near future.

Sugar-beets and vegetables come after rice and wheat in total fertilizer use. In sugar-beets, one of the main reasons for the increased use of fertilizer is the emphasis placed by the Ministry of Agriculture on enlarging the yields of this crop. Another reason that sugar-beet farmers use more fertilizer is that all their crop is sold to the factories at a fixed price and the farmer does not have to worry about the marketing of his product. In vegetables, the great effect achieved by the use of chemical fertilizers is the main reason for their use. The rise in output as a result of applying fertilizers is greater in vegetables than in any other crops.

USE OF CHEMICAL FERTILIZER THROUGHOUT THE MONTHS OF THE YEAR

The greater part of the nitrogenous and phosphatic fertilizers are used during March and April. Their use is minimal during December and January, and July through to September. During October and November, only 10% of the total fertilizers used are applied. Such a curve is very important because it makes it possible to forecast the use of fertilizers through the year, and thus makes it possible to plan the distribution and supplies of fertilizer in time.

FERTILIZER USE IN THE VARIOUS PROVINCES OF IRAN

This is probably the first time that information on the use of chemical fertilizers in the various regions of the country has been gathered together and presented in this way. For this reason, the precision of the figures is only relative, but we are quite certain that the extent of fertilizer use in the various regions is correct.

By looking at the statistics of the irrigated land under cultivation and the land with high precipitation, we will be able to find out which ostans are more or less suitable for the use of chemical fertilizers. This also makes it possible for the future planning of the Ministry of Agriculture's various programmes to be based upon the use of chemical fertilizers.

In the Mazandaran and Gorgan regions of Iran irrigated areas are larger than in others. Thus, it is no wonder that the use of chemical fertilizer is higher in these regions than in all the others.

The second largest extent of irrigated agricultural land is to be found in the Khorassan region, but the use of fertilizer per unit area

of cultivated land in this region has not kept pace with the extent of cultivation itself. The reason for this seems to be its great distance from the ports and the warehouses of fertilizer, and the vastness of the region itself. One can even state with a large degree of certainty that, were it not for the development of sugar-beet growing in this area the present level of fertilizer use would not have been achieved. A similar reason for low fertilizer utilization is operative in Eastern Azarbaijan.

The use of chemical fertilizers per unit area under cultivation in the Gilan region is much higher because of its proximity to ports and to the greater activity of Ministry of Agriculture instructors and planners. From the point of fertilizer use, this region ranks right behind Mazandaran and Gorgan which have been combined into one unit for this comparison.

The use of fertilizer in the Kurdistan, Sistan and Baluchistan regions has remained at quite a low level because of the distances from ports and the lack of irrigatable land. But more could be done to encourage activity in these areas, as well as in the regions of Lorestan. Hamadan, and especially in Kermanshah, which is very well suited to this type of activity. It is to be hoped that the use of chemical fertilizers will reach even the farthest and most isolated points, and that they will be obtainable at lower prices. Only in this way will their use approach the levels already achieved in Mazandaran and Gorgan.

The effect of the agricultural package programme, in view of the expansion of fertilizer use in the distant regions and on crops for which little demand exists, will be very great and for this reason, surely, fertilizer will be one of the agricultural inputs which will be used more than the projected figures in the Fourth Five Year Plan.

Mr. Jebraili is the General Director of Agricultural Education

The Role of Communications in Promoting Fertilizer Use

prepared by Mr. Victor L. Sheldon & Mr. John E. Culp

Throughout history, man has felt an uncontrollable urge to communicate. In fact, we spend 70 per cent of our waking hours in communication - we talk to other people, read newspapers and magazines, listen to radio programmes and phonograph records. We view plays, movies, outdoor ads, television programmes and listen to and deliver speeches.

We spend all this effort to exchange thoughts or opinions. Communications, then, is the process whereby two or more people exchange facts, feelings, impressions or ideas in ways that each gains a common understanding of the meaning, intent or use of messages. Communications has been described as "intercourse by words, letters, or messages". Everything that makes a sound or gesture communicates. Communications is the bridge that connects individuals and forms of society.

Communications is also the basic building block in an educational programme - from a technical short-course to a total national educational programme. Communications is the vehicle for promotion and advertising programmes. As such, communications plays a significant role in our efforts to promote the use of fertilizers - and other agricultural inputs - whether we work for the government or private industry.

As a government, for example, we are interested in promoting the widespread use of fertilizer to help improve the national food and fibre supply. As an industry, we have the same goal; but we are also interested in seeing that farmers buy our particular brand of fertilizer. So the element of advertising and promotion is used to help sell farmers on using a specific product. Along with product, place and price, it forms an integral part of any public or private organization's marketing strategy.

This paper considers specific elements in advertising and promoting a fertilizer product. Many of the communication techniques discussed are as useful in education and extension programmes as they are in selling a product or service.

WHAT IS ADVERTISING AND PROMOTION?

Let's first define the terms we are using. Communications has already been defined as an exchange of information between two or more people.

Advertising is any type of communication effort - verbal or visual - that directly or indirectly influences the sale of a product or service.

Promotion - sales promotion is perhaps more descriptive - is much broader in definition. Sales promotion includes any activity that supplements personal selling and advertising to help make them effective. This includes displays, shows, exhibitions, demonstrations, and other such support activities.

Sales promotion differs from advertising only in terminology; advertising is a form of sales promotion. The advertising department of a large U.S. manufacturing company defines the terms this way: "Sales promotion moves the product towards the buyer, while advertising moves the buyer toward the product".

Both advertising and sales promotion are components of a company's efforts to market its product. Advertising alone cannot be as effective as it is when supported by catalogues, brochures, shows and exhibits, posters, motion pictures and other audio-visual aids.

IDENTIFYING THE TARGET MARKET

The first step in designing an advertising programme is to define the company's target market. This should be done *geographically* - there is always a certain area where a company's sales can most likely be made - called "trade area". For example, farmers may traditionally prefer to do their buying and selling in a certain town or area away from the company's plant. It may be hard to change their habits, so marketing management must decide whether or not to try.

Competition must also be considered in defining a trade area. One company might not want to enter a region where a competitive company is well entrenched. Another consideration is *distance*. A company would not

want to reach out for an audience that farmed in an area so far away that it would be impossible to handle the business efficiently.

After all important considerations are made, the company's geographic trade area should be drawn on a large map and placed where it will be a constant reminder of the company's trade area.

The next step is to define the *types of farming* in the company's trade area. Kinds and acreages of different crops, livestock enterprises and use of improved seed, fertilizer and cultural practices are important considerations. If fertilizer is applied by hand, for example, it would do little good to make a point in the advertising message of equipment compatability.

Each type of land tenure, being a distinct class of trade, may constitute a separate target market. Certainly, each type of crop contributes its own seasonality to the consumption of any one fertilizer.

Analyzing the potential customer - or audience - in the geographic trade area is the most important consideration of all. Without this information it would be impossible to plan messages that could be depended upon to inform and persuade. *The educational level* of the intended audience is critical. We must know the literacy levels to develop meaningful messages. We must know the physical and mental factors that motivate an intended audience. We must know how many farmers prospects are in the trade area. This information can help determine the potential sales that can be made.

Another audience factor is *age*. Young people think differently from older people. They have different ideas, are more aggressive, more willing to seek advice and take risks. Older people demand more proof of a product's attributes and generally are more conservative about change. *Religion* is an important factor, too. People can be offended if advertising shows or tells them something that is not in agreement with their beliefs. *Language* is also important. Any form of communications must "speak" the language of the people. Every group in a society identifies itself closely with certain expressions and mannerisms.

SETTING COMMUNICATION GOALS

With a clearly defined marketing area, the economic, social, political and legal environment, and knowledge of the audience, a fertilizer communications programme can be established. Because the whole communications programme is an integral part of marketing, it is vital that a company clearly define its marketing goals; tonnage desired, in what fertilizer do we place strongest emphasis, the share of the market this

represents, the retail system, the product price, target audience who will buy this fertilizer, and within what time periods should sales be made.

In any environment, fertilizer marketing strategy relies on communications to get the farmer's attention and to tell him what fertilizer is for sale. Its basic, broad objectives are to inform, persuade, or remind target farmers about the firm's marketing mix and the firm itself. The technical nature of fertilizer use and its dependence on other cultural practices for value, requires an intensive effort to inform the end-user. As many communication channels as can be brought to bear on the target market must be used. Extension workers, banks, colleges, civic organizations, youth clubs, public and private marketing organizations and editors - all teamed together - can support economic development by informing farmers of methods of efficient fertilizer use, and by removing constraints at the farm-level.

Now, how do we go about setting up our communications objective? We cannot very well set an objective for a message before we know what we want to talk about. But much of what is needed has already been done once the trade area and potential audience have been identified. The fertilizer plant's operations should be known along with the company's sales goals.

The next step is to consider the *four attitudes that are apparent in any marketing mix: awareness, interest, understanding and preference. Determining the location of a company's product in any of the attitude areas determines the advertising or communications objective.

You normally have to get awareness of the product's name, then interest in what it claims to do for the potential buyer, next an understanding of the reasons behind the promise of better performance and finally, preference for the product over any competing product.

Some part of the prospective audience will be aware of a fertilizer product by name. A smaller number in any trade area will be interested in the benefit it promises. Still fewer will understand why the fertilizer claims to be of benefit. And an even smaller number will prefer the fertilizer to other products.

Communications - or advertising - must be designed to reach prospects in each of the four categories. Sometimes - introducing a new product, for example - it will be best to work with just getting awareness. At other times it would be best to work with the people who are aware of the product and are interested in it, but need more understanding of its benefits before they will decide to buy.

* *Dapron, Elmer J., Advertising Guidelines for the Fertilizer Company, Gardner Advertising Agency, St. Louis, Mo., U.S.A.*

Armed with this kind of information, communications objectives can be set. Such objectives should always be specific. It is not enough to say the communications goal is to reach as many farmers as possible next year. A goal that is clearly defined would be much more meaningful. For example: "We want to reach 50 per cent of the rice farmers in our trade area next year with a message that tells them why they should use our nitrogen fertilizer". That type of communication goal quantifies who is to be reached and with what specific message. It is an attainable goal that can be measured.

CONSIDERING THE MESSAGE

With such a clearly defined communications objective, a company can do a much better job in preparing advertising messages and choosing the right channel of communication.

The most important element of a message about a company's product and service is to fully describe its benefits - use all the facts possible. What are its advantages, features, uses, availability, reputation - from the farmer's point of view? A message should usually give most prominence to the most important fact about the product or its use. Other facts can be used to support the primary message. *Here are a few examples of subjects a company might use:

- Announcement of new trace elements
- Announcement of a new product
- Test reports and field trials
- Interesting case histories (testimonials)
- Profit stories built around use of the company's products
- Promotion of services such as soil testing, forage analysis, book-keeping, credit plans, etc.
- Promotion of produce-use contests
- Promotion of non-fertilizer items to attract new business

A good fertilizer advertisement will cause an audience to respond. In order to do this the offer should benefit the prospect, be clearly stated, tell enough about the offer to warrant prospect action, and be presented in such a way that it builds a decided preference over a competing offer.

Here are some ways advertising can cause quick response:

- Set a time limit on the offer
- Offer only "while supply lasts"
- Provide equipment on a first-come, first-serve basis
- Give a gift for prompt orders

* *ibid.*

Use coupons that can be redeemed when buying
Offer free service for a specified period

Messages should be designed for specific audiences and circumstances. Good advertising is always integrated with selling circumstances and the messages are specifically created to make the greatest impact within these known needs.

In most environments, individual fertilizer products are consumed seasonally. Advertising should reach its most intensive level just before the farmer makes his largest expenditures for the new growing season. By explaining the message to retailers well in advance of the season, the complete marketing campaign can unfold to gain maximum value from the communications.

Sales promotional materials should be used to introduce the campaign and to fortify the theme through a more personal contact with the farmer. Being highly flexible, they can be tailored for appeal to each market class. They are powerful sales-getting weapons in their own right. As such they can have continuing and independent value.

Frequently, fertilizer use is introduced by extension workers. Strong, pictorial, product-use information in print or radio media reinforces these educational programmes by expanding the audience. Farmer meetings, field days, demonstrations of product use or complete fertility programmes add the needed intensity especially where the use of mass media is restricted for the rural audience. Public and private marketing systems alike need to fully utilize sales promotion techniques on a continuing, sustained basis. To ensure that the farmer's needs are satisfied, and that he obtains maximum response from his fertilizer investment, a constant flow of information is required. Sales promotion programmes that explain how to perform improved cultural practices, seed selection, pest and disease control are necessary if repeated fertilizer orders are to be ensured.

The success of a communications programme frequently depends upon the ability of the retailer to advise the farmer orally. Sales promotion materials to encourage and assist these contacts perform a key role in the total marketing strategy.

GETTING OUT THE MESSAGE

Selecting the channels of communication - or media - for a company's message will always be regulated by the ability of the company to deliver to and service the customers. Obviously no communications should be placed beyond the company's trade boundaries.

The available media in a trade area should be inventoried by the advertising manager. Coverage of radio stations, number of outdoor billboards, newspaper and magazine circulation, cinema availabilities, and other media capabilities should be carefully evaluated. Here is a suggested evaluation technique for determining whether or not to use a specific advertising medium:

- How much of the total audience you wish to contact does the medium reach?
- Does the medium reach your audience with minimum waste exposure? Example: You would not use television if only a small percentage of the TV audience was potential customers.
- Is the message exposed over enough time to be effective?
- Is the message told enough times and thoroughly enough to get action?
- Costs of using each medium.

Following is a listing of the more prevalent advertising media and a general statement of advantages and disadvantages.

Radio is the great notifier. Radio is one of the most important communication channels. It can span literacy, distance, and time barriers. In a developing country it can be the most effective way to communicate an idea or information about a product. It is excellent for creating awareness in a product or service; it is relatively inexpensive and easy to use. Radio messages are short-lived as compared to a newspaper ad, and are not suited to creating understanding in highly technical subjects.

Television has been called the most important educational tool since movable type. It reaches a large audience - the farm audience may be small, however - with great impact because it has motion, entertainment, and is persuasive. It creates awareness, interest, understanding, and preference. Television is a high-cost medium, and may have too much "waste" in audience coverage for most farm product advertising.

Newspapers print is one of the oldest and most effective means of presenting information. It is relatively low-cost advertising, a regular source of information, adapted to detailed messages and to create interest and understanding and can be passed from one person to another. Newspapers often have large waste circulation among non-farm readers; reproduction is sometimes poor; and newspapers have a short life compared to magazines.

Direct Mail is used by more advertisers around the world than any other medium. It can be directed to specific audiences - almost to the point of being personal; it does not compete with other advertising - it has the reader's attention, does not have space and time limitations and can be produced on a company's rigid schedule. Direct mail is excellent in creating understanding about a product. The biggest disadvantage is developing and maintaining accurate mailing lists. Development and sale of mailing lists has become a booming business in many nations.

Magazines offer the advantage of presenting in-depth product information to create understanding about a product or service. They are almost as effective as direct mail in this regard. However, magazine advertising may be expensive and preparing ads requires technical help in photographic plates and other techniques of print media.

Billboards rank high as an efficient advertising medium. Messages are exposed over a long time period and can be placed in strategic locations. Billboards are often in short supply, however, and only a few words can be used. Another disadvantage is that not all areas have reliable billboard posting companies.

Exhibits are expensive on a per-person reached basis but are useful in promoting product understanding.

Demonstrations can help a company show living proof that his product works well. Simple demonstrations can show the value of fertilizer in increasing crop yields.

Miscellaneous Media such as point of sale banners, gifts, and posters can increase sales volume. They should be simple, easy to understand, and supplement other effects. Dramatized plays, cinema, loudspeakers, plus handbills and leaflets can be effective in certain situations.

Media selections should be made on the basis of the physical form that will get the farmer's attention, provide the lowest cost per prospect, and be capable of reaching a designated audience. But the time invested may mean the difference between an ineffective and a successful advertising programme. Recognizing that advertising is one of the causes of sales, budgeting should be based on its role in the long-range marketing plan. Short-term decisions utilize a summation of individual costs

of all the elements of the marketing communications programme. This task method does not ignore the factors of sales cost and anticipated profit. But it applies these factors after the cost has been determined in the specific marketing environment. The method is valuable because it provides all the information necessary to justify the requested funds. It forces the planner into thorough research and investigation of all the marketing problems associated with the products being promoted, so that every possible cost is considered. The task method permits the planner to capitalize on marketing opportunities that may have gone unnoticed without such research. It encourages detailed planning. After this first overview consideration, a re-analysis quickly points out where the programme can be tightened. The cost of each component can be weighed against the value to the complete marketing programme.

Often the funds budgeted for communications depend upon the stage of the life cycle of the product being marketed. To create an awareness during the introduction of a new fertilizer may require an investment of five per cent of the projected gross receipts in any one campaign. These monies return dividends over the entire span of the product's life. In later stages the marketing mix changes and the media change. Funds budgeted for communications may lessen.

In any event, no marketing programme, whether managed by a public or private organization, can succeed without its communications component. By comprehensively planning with other marketing functions, communications create added value to the fertilizer and enhance overall marketing efficiency.

EVALUATING THE COMMUNICATIONS

Many businessmen believe that advertising's results cannot be measured. This is the reason there are few attempts to measure advertising. However, when planners clearly state the specific results they want from advertising, it can and should be measured.

If the advertising budget was set according to communication goals, and those goals have been met, then the advertising must have been successful. The company should know exactly what advertising contributed to the marketing mix. The means for exact measurement must be set up before executing the advertising plan.

*One way to help determine expected performance from advertising, is to pre-test the advertising's effect on a small group of people. About 100 farmers could be selected for a special mailing, then the results tested against a minimum sales goal. This kind of testing will

* *ibid.*

save money and will even make money when it shows the way to profitable promotions.

Here are three practical ways to test advertising after a campaign has been completed:

1. Personal interviews is the most direct method. However, personal interviews take time and some people will not say what they really think in the presence of an interviewer.

2. Questionnaires are relatively inexpensive and excellent for getting response from large numbers of people. For objective answers, however, questions must be neutral, not positive or negative. Rate of return can be a problem unless there is an incentive offered.

3. Objective discussions among those responsible for the campaign is effective. They can often determine among themselves whether the project was successful.

Dr. Sheldon is the Chairman of the Department of Agriculture, Western Illinios University.

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SHELDON, Victor L., Advertising and Sales Promotion Prototype Programme, New York: Agroservice Selling, Volume IV, Esso Chemical Company, 1966.

LIST OF DELEGATES

IRAN

Mr. Ghulam Hussain Ghandehari	Distributing Company for Chemical Fertilizer
Mr. Ali Seyed Ahmedian	Central Organization for Rural Co-operatives of Iran
Mr. Mohammad Taghi Jebraili	General Director of Agricultural Education (Co-ordinator)
Mr. Iraj Nassiri-Toossi	Division Chief, Soil Extension Division, Soil Institute of Iran

PAKISTAN

Mr. Jehangir Shah Jogazai	Joint Secretary, Ministry of Food & Agriculture, Islamabad
Mr. S. Barkat Ahmad	Officer on Special Duty, Ministry of Food & Agriculture, Islamabad
Mr. S.Z.H. Zaidi	Deputy Secretary, Ministry of Food & Agriculture, Islamabad
Mian Mumtaz Ali	Deputy Agricultural Development Commissioner, Ministry of Food and Agriculture, Islamabad
Mr. K.M. Azam	Chief of Agriculture, Planning Division, Islamabad
Col. Shaukat Ali	General Manager, Federal Directorate of Agricultural Supplies, Lahore
Khan Musahib-ud-din Khan	Director General (Research) Agricultural Research Institute, Lyallpur
Mr. Nasir Ahmad	Managing Director, Punjab Agricultural Supplies Corporation, Lahore

Mr. Saeed Khan Leghari	Deputy Director, Sind Agricultural Supplies Organization, Sukkur
Mr. S. Usman Ahmad	Deputy Director, (Economics and Marketing) Directorate of Agriculture, Government of NWFP, Peshawar
Mr. Abdul Sattar	D.A.D.A., (Marketing), Directorate of Agriculture, Government of Baluchistan, Quetta.
Dr. A. Rahim Chaudhry	Executive Director, Agricultural Development Bank of Pakistan, Islamabad
Dr. Mohammad Aslam	Lecturer, Department of Agricultural Marketing, Agriculture University, Lyallpur
Mr. S. Abu Khalid	Marketing Manager, Dawood Hercules Chemicals Limited, Lahore
Khawaja Amanullah	Dawood Corporation, Lahore
Mr. B.A. Qureshi	Managing Director, PNO Agricultural Services, Lahore
Dr. K. Ziauddin	Operative Director, M/S Jaffer Brothers Limited, Karachi

TURKEY

Mr. Sezai Bayraktar	Technician at Plant Nutrition Section, General Directorate of Agricultural Affairs (Co-ordinator)
Dr. Kemâl Kaptan	Head of Planning and Budget Department, General Directorate of Agricultural Affairs
Mr. A. Kemâl Acarer	Senior Agricultural Engineer, Izmir Section, Agricultural Research Institute
Mr. Mahmut Erdir	Senior Agricultural Engineer, Director of Planning Department, Agricultural Equipment General Directorate

UNITED KINGDOM

Mr. K.E. Smallpage	Senior Administration Controller, Fisons Limited
Mr. K.F. Isherwood	Agricultural Economist, International Superphosphate and Compound Manufacturers' Association Limited

UNITED STATES

Mr. D. Robert Schmeltz	Manager, Singapore Operations International Minerals and Chemical Corporation (Pacific)
Dr. Victor L. Sheldon	Chairman, Department of Agriculture Western Illinois University
Mr. Karl Wierer	Marketing Economist, Marketing and Credit Service, F.A.O., Rome
Dr. Darrell A. Russel	Agriculturist, Division of Agricultural Development, Tennessee Valley Authority

SECRETARIAT

Mrs. Fugen Ok	Assistant Economic Secretary (Conference Officer)
Mr. G. Yazdani Dar	Documents Officer/Supervisor, Typing Pool

* 1. Seminar on Cattle and Sheep Breeding, 1959
* 2. Seminar on Land Classification and Soil Survey, 1959
3. Seminar on Forestry, 1959
* 4. Conference on Minerals, 1959
* 5. Progress Report, Co-ordinating U.S. Action for CENTO, 1959-60
* 6. Conference on Development Programming, 1960
* 7. Symposium on Chrome Ore, 1960
* 8. Conference on Teaching of Preventive Medicine, 1961
* 9. Conference on Industrial Development Banking (1), 1961
* 10. Symposium on Coal, 1961
* 11. Progress Report, Co-ordinating U.S. Action for CENTO, 1961-62
12. Travelling Seminar for Increased Agricultural Production, 1962
* 13. Conference on Agricultural Development Banking, 1962
* 14. Conference on National Income Accounting, 1962
* 15. Conference on Development Planning, 1962
* 16. Conference on Teaching Health Centres, 1962
* 17. Conference on Industrial Development Banking (2), 1962
* 18. Conference on Establishment of National Scientific Organizations, 1962
* 19. Symposium on Industrial Rock and Minerals, 1962
20. Seminar on Cost and Return Ratios for Major Agricultural Products, 1963
21. Conference on Teaching of Science, 1963
* 22. Symposium on Rural Development, 1963
* 23. Sumposium on Iron Ore, 1963
* 24. Symposium on Consumer Expenditure, 1963
25. Conference on Agricultural Development Policy, 1963
26. Sumposium on Management Training in Public Administration, 1964
27. Conference on Nursing Education, 1964
28. Conference on Hospital Administration, 1964
29. Travelling Seminar on Range Management, 1964
* 30. Conference on Manpower Needs and Training of Environmental Sanitation Personnel, 1964
* 31. Symposium on Mining Geology and the Base Metals, 1964
32. Travelling Seminar on Agricultural Credit and Co-operatives, 1964
33. Symposium on Industrial Statistics, 1964
34. Symposium on Scientific and Industrial Research, 1964
* 35. Second CENTO Veterinary Pathology Seminar, 1964
36. Symposium on the Role of Local Government in National Development, 1965
* 37. Symposium on Tax Administration, 1965
38. Symposium on the Development of Capital Markets, 1965
39. Travelling Seminar on Veterinary Education and Animal Health, 1965
* 40. Travelling Seminar on Fresh Fruit and Vegetable Marketing, 1965
* 41. Seminar on Field Techniques for Mineral Investigation, 1965
* 42. Progress Report, Co-ordinating U.S. Action for CENTO, 1962-65
43. Symposium on Hydrology and Water Resources Development, 1966
44. Conference on Land Classification for Non-Irrigated Lands, 1966
45. Symposium on Household Surveys, 1966
46. Summer Training Programme in Geological Mapping, 1966
47. Travelling Seminar on Farm Tools and Implements, 1966
48. Symposium on Mine Health and Safety, 1966
49. Conference on Engineering Education, 1966
50. Conference on Agricultural Extension, 1967
51. Travelling Seminar on Processing and Marketing of Fruit and Vegetable Products, 1967
52. Summer Training Programme in Geological Mapping, 1967
53. Conference on National and Regional Agricultural Development Policy, 1967
54. Symposium on Agricultural Statistics, 1967
55. Travelling Seminar on Marketing of Livestock and Livestock Products, 1967
56. Conference on Combatting Malnutrition in Preschool Children, 1968

57. Symposium on Development and Utilization of Mineral Resources, 1968
58. Conference on Industrial Vocational Education, 1968
59. Conference on Earthquake Hazard Minimization, 1968
60. Report of the Ad Hoc Working Party on Fertilizers, 1968
61. Decade of Development, a Ten-Year Compendium, 1959-69
62. Symposium on Demographic Statistics, 1968
63. Progress Report, Co-ordinating U.S. Action for CENTO, 1965-69
64. Geology and Ore Deposits of the Lakan Lead-Zinc District, Iran, 1968
65. Symposium on Manpower Planning and Statistics, 1969
66. Conference on National and Regional Livestock Development Policy, 1969
67. Geology and Ore Deposits of the Sizma-Ladik Mercury District, Turkey, 1969
68. Conference Series on the Teaching of Public Health and Public Health Practice, 1970
69. Conference on Broadening Public Participation in Equity Investment, 1970
70. Travelling Seminar on Management and Financing of Marketing Co-operatives, 1970
71. Conference on Forestry Development Policy, 1970
72. Seminar on Veterinary Investigational and Diagnostic Methods, 1970
73. Travelling Workshop on Range Management, 1970
74. Symposium on Price Statistics, 1970
75. Workshop Series on Clinical and Applied Research on Family Planning, 1971
76. Workshops on Marketing of Livestock and Their Products, 1971
77. Symposium on Central Banking, Monetary Policy and Economic Development, 1971
78. Seminar on Agricultural Planning, 1971
79. Seminar on Agricultural Aspects of Arid and Semi-Arid Zones, 1971
80. Seminar in the Application of Remote Sensors in the Determination of Natural Resources, 1971
81. Seminar on Industrial Relations, 1972
82. Seminar on Public Health and Medical Problems Involved in Narcotics Drug Addiction, 1972
83. Workshop on Educational Responsibilities of Nurses and Midwives in Relation to Family Planning in Maternal and Child Health Services, 1972
84. Seminar on the Control and Eradication of Viral Diseases in the CENTO Region, 1972
85. Seminar on Budget Administration, 1972
86. Seminar on Highway Planning and Administration, 1972
87. Workshop on Agricultural Planners, 1973
88. Conference on the Methodology of National Health Planning, 1973
89. Seminar on Hospital Administration, 1973
90. Workshop on Evaluation of Nursing Educational Achievement, 1972
91. Conference on Family Planning, Health & Demographic Statistics, 1973
92. Seminar on Industrial Disputes Settlement, 1973
93. Workshop on Airport Management, 1973
94. Conference of University Rectors, 1974.

* *Out of print*

The above list includes all publications financed by the Office of the U.S. Economic Co-ordinator for CENTO Affairs. Most of the older books are now out of print and are no longer available. However, copies of those still in stock may be obtained by writing to:

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