

AN ANALYSIS OF THE PERFORMANCE OF
FERTILIZER DISTRIBUTION SYSTEM
IN WEST PAKISTAN

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MUHAMMAD ASLAM CHAUDHARY
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This is to certify that the

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Muhammad Aslam Chaudhary

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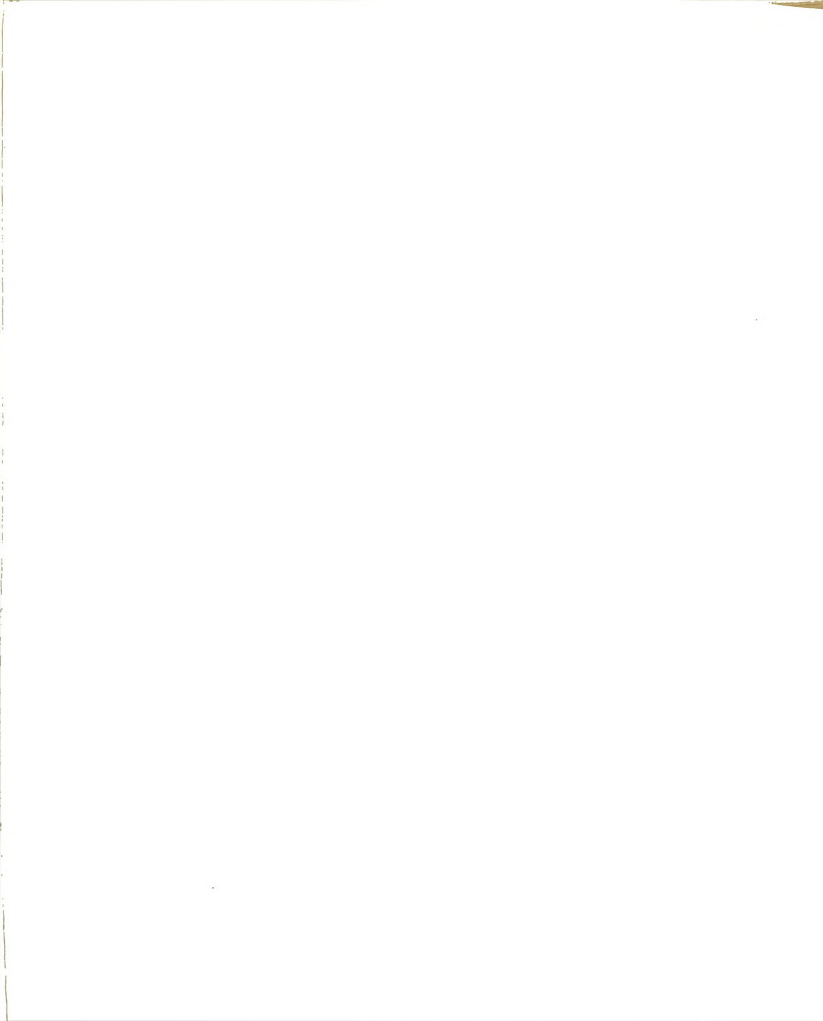
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ABSTRACT

AN ANALYSIS OF THE PERFORMANCE OF FERTILIZER DISTRIBUTION SYSTEM IN WEST PAKISTAN

By

Muhammad Aslam Chaudhary

This study analyzed the existing system of fertilizer distribution and its efficiency in responding to the various institutional and economic forces including a rapidly expanding demand for fertilizer in West Pakistan. A theoretical analysis of the farm input markets in less developed countries helped to identify the variables affecting the operation of the fertilizer market. An evaluation of the performance of the fertilizer market channel for ownership and control on the basis of the following criteria was carried out:

1. Exchange mechanisms operating at various levels of the vertical segment of the market channel.
2. Progressiveness.
3. Channel efficiency.
4. Channel coordination.



The analysis indicated that the current system of channel organization did not satisfy the above criteria as well as the norms of effective competition. In order to improve the overall performance of the distribution system, it was suggested that the existing system of allotment, quotas, fixed marketing margins, and regulated fertilizer prices be replaced by a system relying on the free adjustment of the market forces of fertilizer supply and demand. A transfer of ownership from public to private enterprise should take place in order to promote the internal growth of fertilizer distributing firms, inter-firm competitive strategy, and to reduce bureaucratic inefficiency. An alternative privately organized oligopolistic fertilizer channel structure was proposed to attain the objectives of: (1) improved resource allocation, (2) stimulation of technological progress, (3) market coordination, and (4) product suitability.

The study specifically explored the reasons underlying three interrelated phenomena of:

1. Volatility of fertilizer imports.
2. Unavailability at the farm level at desired time.
3. Complementarity between fertilizer use and other farm inputs.

An analysis of the variables affecting the structure of fertilizer supply tended to support a

hypothesis that inefficiencies in the fertilizer distribution system accrue from the volatility of fertilizer imports. A similar analysis relating to the reasons accounting for the variation of growth rates in various agricultural regions of West Pakistan indicated a positive correlation between the level and intensity of fertilizer use and the availability of complementary farm inputs.

A strategy of fertilizer distribution in five designated regions through a chain of distribution centers and sub-centers was proposed to improve the physical flow of fertilizers and to ensure greater local availability. The systems of fertilizer transportation and warehousing need coordination at various levels of the distribution system to reduce temporal delays and spatial variations in fertilizer supply.

An examination of the existing processes of fertilizer allocation showed that the two major sources of conflict in the system of allotment, quotas, and fixed prices were:

1. The allocative function of the government in relation to fertilizer distribution agencies.
2. The role of economic planning in restricting the operations of fertilizer distributors.

An analysis of the existing system of comprehensive control on fertilizer prices indicated that it was difficult to supervise and that it should be replaced by a

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pricing system with relatively relaxed market exchange rules and relying more on a free market operation.

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Dedicated very affectionately
to my parents

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CHAPTER I

INTRODUCTION

In spite of a significant structural change that has taken place during the last two decades in the economy of Pakistan, agriculture continues to contribute almost one-half of the gross national product. As a basic sector, agriculture tends to dominate all forms of economic activity in one way or the other. Agricultural raw materials and farm products account for nearly 75 percent of the total foreign exchange earnings.¹ No less than 85 percent of the population lives in rural areas and most of it is directly or indirectly dependent on agriculture for its livelihood.² Severe pressure of population and subdivision of holdings has led to a continuous decline in the size of farms to the current average of 6.4 acres which is one-forty-seventh of the average in the United States and one-sixteenth of the average in Britain.³

¹Government of Pakistan, Planning Commission, The Third Five Year Plan (1965-60), June, 1965, pp. 110-15.

²Ibid., p. 116.

³Malik Khuda Buksh, "Agricultural Progress in Pakistan," unpublished paper read at an International Conference held by Rockefeller Foundation, 1969, p. 13.

West Pakistan faces almost similar conditions. As much as 20 percent of the land area of this region is cultivated which is estimated to be around 46 million acres of land.⁴ The average size farm in West Pakistan is slightly higher than the national average. The cultivated land-man ratio of 0.9 acres and the per capita income of Rs 1.28 or about 27 cents per day enables an average West Pakistani to have food containing 2100 calories per day.⁵ Almost 25 percent of the cultivated area remains fallow.⁶ The causes may vary from scarcity of irrigation water, uncertainty in rainfall, lack of modern farm practices to inadequacy of soil fertility. A major reason accounting for low crop yields and vast areas of fallow land is the low level of fertility in the soil. The continuous depletion of plant nutrients removed from the soil by constant cultivation of land for centuries accompanied by inadequate replenishment of these nutrients by traditional organic manure has resulted in extremely low levels of soil fertility. Apart from other high productivity inputs, a major single farm input that can accelerate the rate of agricultural growth and relieve

⁴Government of West Pakistan, Bureau of Statistics, Planning, and Development Department, Statistical Handbook of West Pakistan, 1967, Table 4, p. 5.

⁵Ibid.

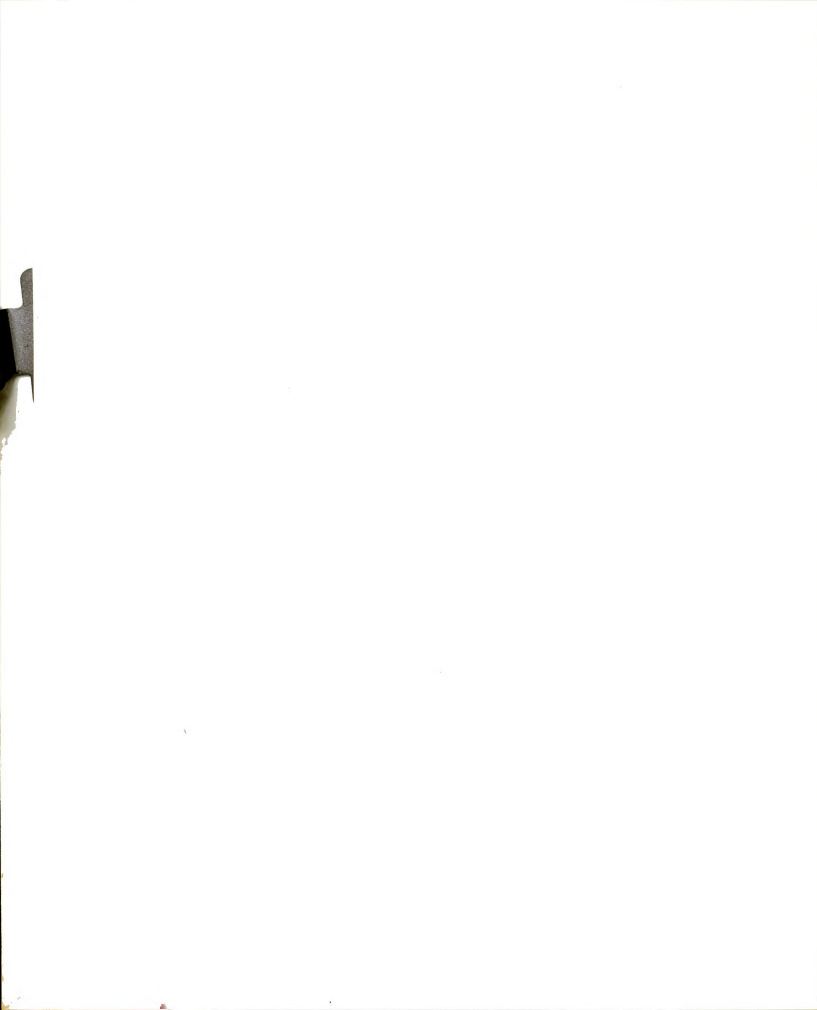
⁶Ibid.

the ever-increasing pressure of population on land generated by a rapid rate of population growth is chemical fertilizer.

While almost all possibilities of expanding the agricultural land through extensive cultivation of marginal and, in some cases, sub-marginal land seem to have been tapped, agricultural land has received an extra squeeze from increased industrialization and urbanization. At present, the basic need is to introduce land-saving technology that may bring about a right-ward shift in the agricultural supply function as well as effect a transfer of surplus labor, land, and capital for non-agricultural uses. Fertilizer use can well create the possibilities of increased multiple-cropping, changing the crop rotation, and increasing the density of plants. Ibach in the United States, indicates that one ton of N-P-K can substitute for 9.4 acres of land at 1960-64 average crop and fertilizer prices.⁷ He further indicated that without previous use of fertilizer, one ton of fertilizer can substitute for 600 hours of labor with an initial zero level of fertilizer application.⁸

⁷D. B. Ibach, Fertilizer Use in the United States, USDA Economic Research Service, Agricultural Economics Report No. 92 (Washington, D.C.: Government Printing Office, 1966).

⁸Heady, et al., Roots of the Farm Problem (Ames, Iowa: Iowa State University Press, 1966), pp. 117-29.



Substitution of inorganic fertilizers for supply inelastic cultivable land is necessitated by the fact that it is a low-cost and relatively elastic input as compared to traditional organic manure which is presumably of high cost and inelastic in supply response. Since fertilizer use tends to interact with research, institutional inputs and a number of non-conventional inputs that tend to induce a significant shift in the crop potential through interaction effects, it may well be hypothesized that the marginal value product of a unit of capital invested in intensifying the use of modern inputs on cultivated lands is much higher than from bringing additional acres of land under cultivation in West Pakistan. An essential characteristic of modern farm inputs is their low price and capacity to yield a higher level of permanent income stream as compared to traditional inputs. Thus, it is the divisibility and close complementarity with improved crop varieties and the potentiality to yield quick returns that gives fertilizers an edge on other farm inputs.

Statement of the Problem

Increased fertilizer use has been a major factor in increasing crop yields in many of the technologically advanced countries. In the United States alone, almost one-half of the increase in crop yields from 1940 to 1955

can be attributed to the intensive use of fertilizers.⁹ The contrast among various countries in pounds of nitrogen used per acre of cultivated land and per head of the total population is very prominent. 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.¹⁰ It has been noted that in spite of intensive use of agricultural inputs in developed countries, the marginal rate of return from investment in fertilizer has continued to be substantially higher than those from investments in other farm inputs. In the United States, a recent study showed that the ratio of the value of marginal product-to-unit cost for fertilizer is 5.0, 4.2, and 4.0 times as high as that for labor, land, and buildings, respectively, and similar other farm inputs in the agricultural sector.¹¹ Previous studies carried out in the United States indicate a persistently high marginal product-to-unit ratio of fertilizer which is an indication of a relatively higher rate of innovation and technical

⁹ Zvi Griliches, "Sources of Measured Productivity Growth: U.S. Agriculture, 1960-66," Journal of Political Economy, LXX, Nos. 1-4 (1963), 331-46.

¹⁰ See Table A-2.

¹¹ Gian S. Sahota, Fertilizer in Economic Development: An Econometric Analysis (New York: Frederick A. Praeger, Publishers, 1968), pp. 165-88.

change in the production, distribution, and use of fertilizer.¹² It is apparent that 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 use in enhancing the productivity of agricultural sector in Pakistan can be assessed from the fact that it ranks second only to irrigation water as an explanatory variable for increased agricultural growth. Harvard economic advisors working with the Pakistan Planning Commission attributed 25 per cent of the gross value added in crop output to increased fertilizer use during the second five year plan (1965-70). In addition to the general continuously rising demand for fertilizers in the Western part of Pakistan, emergence of new highly fertilizer responsive dwarf varieties has included a major shift in the level of crop output. Consequently, it has lead to a considerable expansion in the demand for fertilizer. Fertilizer use is expected to rise further, if the momentum of farm output in a single-shift equilibrium process is to be maintained. With the existing fixed indigenous fertilizer production capacity and a right-ward shifting demand for fertilizer, a rising volume of imports will be required in order to maintain a stable

¹²Haldore Hanson, West Pakistan Agricultural Growth, Miscellaneous Report No. 22 (East Lansing, Michigan: Michigan State University, 1967), pp. 23-27.



and remunerative fertilizer price level. On the other hand, in view of the scarcity of foreign exchange and uncertainty in the timing of fertilizer imports with the seasonal pattern of domestic demand for fertilizer, a major emphasis of the government of Pakistan has been to develop indigenous fertilizer production capacity.

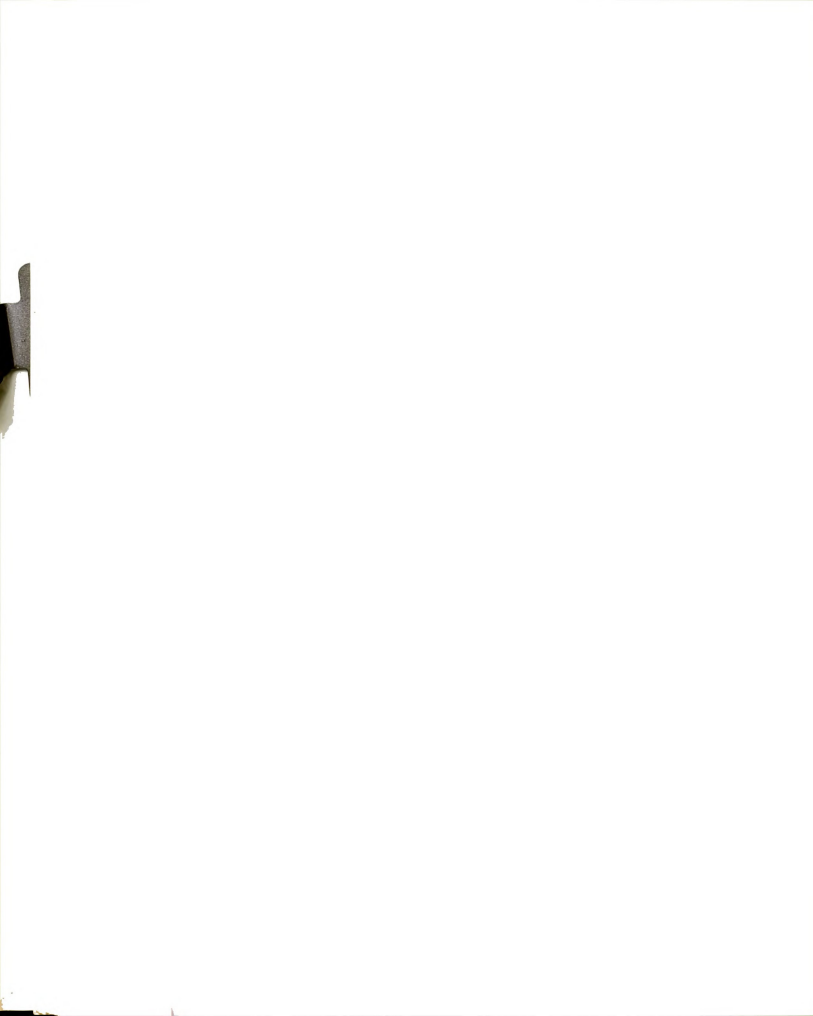
Apart from a number of developments that have taken place in the fertilizer market, the major difficulty arises in regard to making fertilizer available to the farmer in desired quantities and at the required time and place. A number of issues that need investigation are whether or not the existing system of fertilizer distribution is responsive enough to the changed environment in the fertilizer market of West Pakistan sign of interrogation. How far the administrative and organizational inefficiencies, the structure of fertilizer supply and demand, or fertilizer policy itself stand in the way of bringing fertilizers within effective reach of farmers? What are the reasons underlying the emergence of black-market prices in the various areas of West Pakistan?

For the private sector, the barriers to entry may be too high because social returns from fertilizer distribution and market expansion are much higher than private returns. Whereas a public-supported system of distribution may be too slow in effectiveness and accomplish too high a cost, the task of market expansion of

fertilizers. The uncertainty in availability and inaccurate timing of fertilizer imports give rise to the need for linking fertilizer producing plants and the importing agencies with the internal marketing system so as to make fertilizer readily available to the farmer at the local level. The fertilizer distribution system should be dynamic and efficient enough so as to adequately replace or modify the existing administratively determined system of fertilizer distribution. It is not the attempt to execute a major shift from command approach to market approach, but to suggest a balance between the two approaches in a manner that may pave the way for an eventual progressive and profit-motivated system of fertilizer distribution. This study is, therefore, undertaken to improve the physical flow of fertilizers through various institutions currently existing in West Pakistan and to suggest ways of removing the bottlenecks arising from the interaction of the forces of supply and demand with the distribution of fertilizers and how the distribution system reacts to them.

Objectives of the Study

1. To develop a relevant theoretical analysis concerning the development, operation, and interaction of product and factor markets for agriculture in less developed countries and



identify the variables that may be relevant to the development of the fertilizer market in West Pakistan.

2. To examine the variables affecting the structure of supply and demand for fertilizers in West Pakistan and their impact on the fertilizer distribution system.
3. To examine the existing fertilizer market channel and to propose an alternative system of channel organization and physical distribution.
4. To describe the existing practices of fertilizer allocation by the government to various fertilizer distribution agencies and to examine any conflicts arising from the allocative policy of the government.
5. To examine the existing system of fertilizer pricing and to suggest an alternative pricing policy.

Hypotheses to be Examined

A number of hypotheses that will be analyzed in the light of available evidence are given below:

1. Apart from favorable fertilizer response and economic environment fertilizer use depends upon the physical availability of this farm input at the local level.



2. Uncertainty and the variability of fertilizer imports account for major inefficiencies in the distribution of fertilizer in West Pakistan.
3. Diversity in the growth rate of various agricultural regions of West Pakistan may, in part, be attributed to the level of fertilizer use per acre.

Research Procedure

With the recent shift in the orientation of agricultural factor markets in less developed countries from an almost complete dependence on on-the-farm resources to off-the-farm sources of inputs, the need for research on the operation of input markets has received added emphasis. Except for a few studies conducted with the objective of a broad analysis of input-related markets, the field of fertilizer markets has remained unexplored. This study has been undertaken with a view to examining the various economic forces operating in the fertilizer market of West Pakistan, and to make some value judgments on the efficiency of the fertilizer distribution system.

The research approach employed in this study is economic engineering and institutional. In this method an analysis of the market channel will be conducted to examine the physical flow of fertilizers from industrial producer to the farmer-consumer. The marketing process

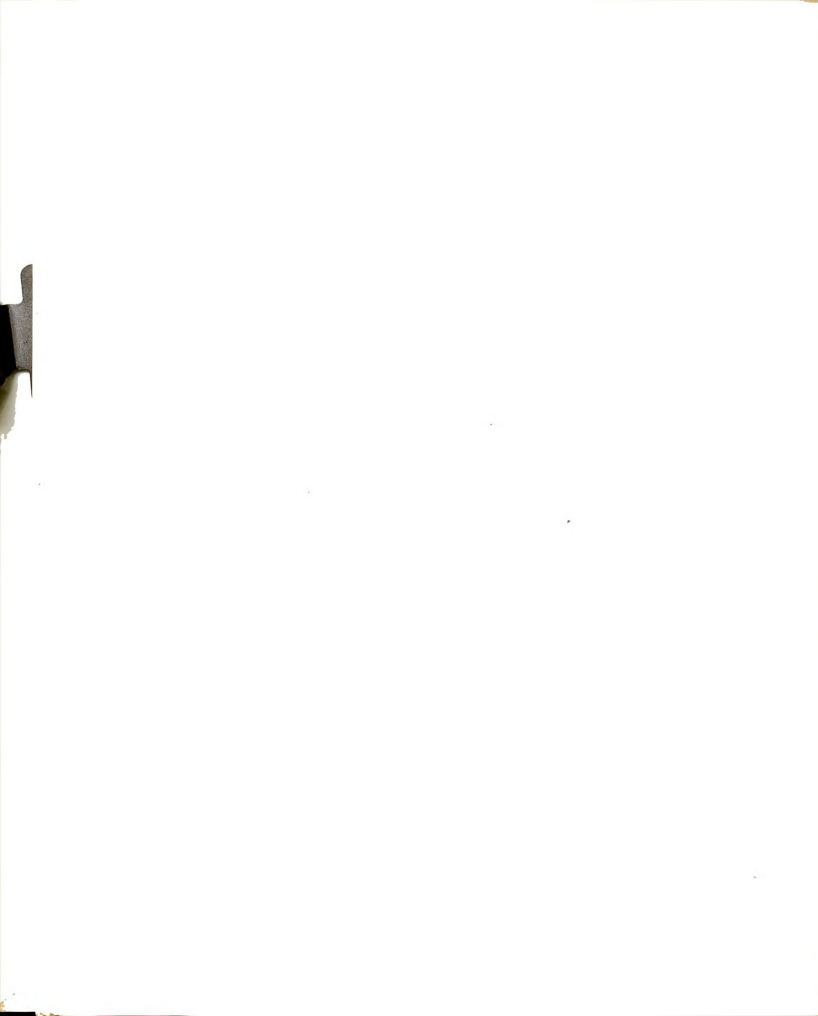


will be broken down into various individual stages of productive activity and interrelationships between the various marketing variables will be examined.

Institutional approach will also be used to examine the role of government in influencing the behavior of market participants through its fertilizer as well as price policy. Available secondary data will be used to support or refute the arguments in the analysis. The major limitation of this study, however, remains the lack of specific disaggregated data in order to conduct an indepth analysis of the various aspects of fertilizer distribution system.

Organization of Thesis

A theoretical framework concerning the operation of factor and product markets in agriculturally less developed countries will be laid out and a course of action for the transformation of traditional agriculture through reorganization of input markets will be recommended. This is followed by a description of the structure of the fertilizer industry and instability of fertilizer imports. An analysis of a number of non-economic strategic factors that in one way or the other determine the demand for fertilizer is included. An examination of the fertilizer market channel in its historical perspective is presented and transformations in the market channel configuration are delineated. An analysis of the



fertilizer market channel with a view to examining the behavior of market participants is presented. In addition, utilizing the current system of fertilizer distribution as a starting point, an alternative growth-oriented regional marketing system with consideration towards the provision of marketing services has been put forth.

An economic model relating to the spatial and temporal structure of fertilizer demand up to the year 1974-75 has been formulated. An analysis of the projected demand and supply patterns for fertilizer is made and an assessment of the impending requirements of fertilizer imports, transportation, and warehousing needs is conducted and a course of action is suggested for the development of indigenous fertilizer production capacity.

The role of government as an important variable affecting the performance of the fertilizer distribution system is examined and policy suggestions for the gradual withdrawal of government from a comprehensive control over the distribution and allocation functions to the replacement of private enterprise are made. An analysis of the process of emergence of blackmarket prices and effectiveness of fertilizer subsidy in promoting the use of fertilizer is delineated.

Based upon foregoing analysis, recommended actions are outlined for the improvement of the performance of the fertilizer distribution system in West Pakistan.



CHAPTER II

ON THE THEORY OF FACTOR MARKETS FOR
AGRICULTURE FOR LESS DEVELOPED
COUNTRIES

Introduction

A very common phenomenon that characterizes the economies of developing countries is the inadequacy of traditional market structures to dynamically adjust and respond to the distributive and organizational needs of modern, non-farm technical inputs. The purpose of this chapter is to present a broad analysis of the variables that tend to affect farmers' decision-making environment and go towards promoting the growth of product and factor markets in less developed countries. It presents the operation of farm input markets in the dynamic and developmental context where the institutional, economic, and policy issues are presumed to be interrelated. It focuses on the changes that must accrue in the product and factor markets as a result of the lift-off in agricultural economy from static equilibrium into dynamism. Its main objective, however, is to provide an initial setting for the analysis and operation of the fertilizer market in West Pakistan.

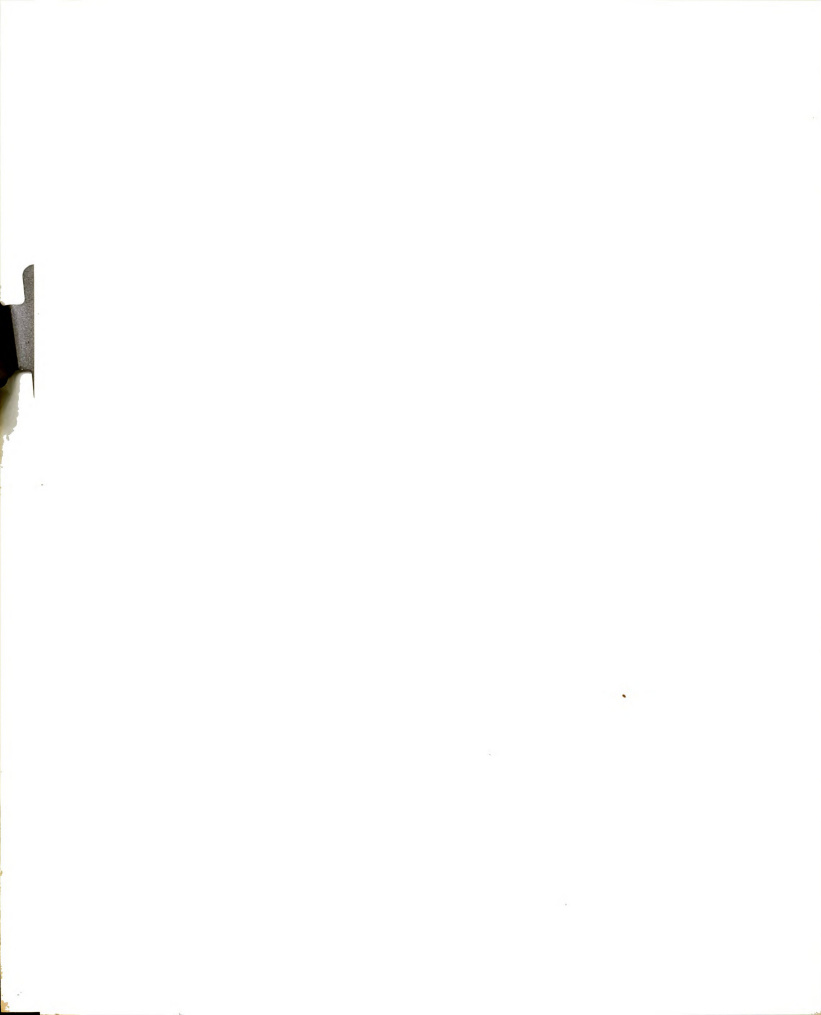
Theoretical Framework

A theoretical classification, on the basis of a broad comparison of agricultural conditions in underdeveloped countries can be made in terms of traditional and modern agriculture. Traditional agriculture may occur in a wide variety of institutional forms ranging from highly communalized systems to small farms organized around the family unit under a wide range of physical economic and cultural factors, all of which affect resource use. A common characteristic of traditional agriculture may be viewed as a chronic state of low-level equilibrium in agriculture that subsists on a traditional factor market. Schultz's concept of traditional agriculture is that:

. . . traditional inputs have been so extensively used by farmers that the motives for holding and acquiring agricultural factors as sources of income stream have remained constant for a long time. So much so that the marginal preferences and motives for acquiring agricultural factors as sources of income seem to have arrived at an equilibrium. The marginal productivity of these sources being viewed as an investment in permanent income streams and the marginal savings assumed to have reached zero.¹³

In the expost sense, traditional agriculture can be viewed as an equilibrium at which agriculture arrives over a long period of time. In the process of reaching this type of equilibrium, the stock of traditional material factors of production are the principal variables. Traditional

¹³T. W. Schultz, Transformation of Traditional Agriculture (New Haven, Conn.: Yale University Press, 1964), pp. 11-75.



agriculture may involve a variation in the size and composition of the reproducible material factors of production that may change because of investment or disinvestment without involving any qualitative or technological changes in the traditional inputs.

A breakaway from this static agricultural system can be attained by the provision of low-priced and high-yielding inputs that may precipitate a state of dynamically shifting equilibrium. The transformation of traditional agriculture essentially involves the restructuring of farm input markets that requires the use of off-farm inputs instead of on-the-farm inputs. A traditional factor market typically represents a relatively inelastic supply of traditional inputs and high-priced sources of permanent income streams. The rate of return to marginal investments is so low that it may barely cover the marginal input cost. The process of accumulation in the stock of traditional farm inputs and declining marginal productivity of investment act as a disincentive to marginal savings such that an equilibrium gets established between savings and investment or between the demand and supply of agricultural factors. Under such conditions, a recombination of the factors at the disposal of farmers will not bring about a significant change in farm output. A rise in the value of farm products could raise the marginal returns to agricultural factors and induce some additional investment.



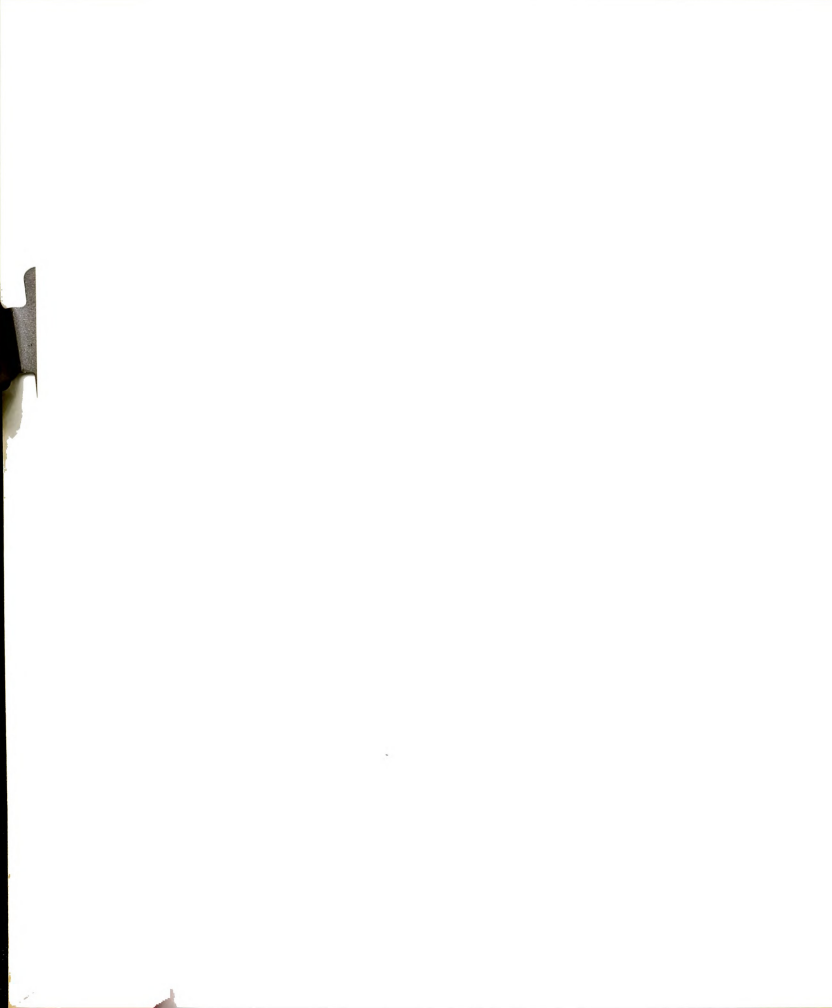
It is likely to be a short-run phenomena that may affect the farm income through farm price variations due to weather which can be described as oscillations around the chronically low state of equilibrium.

The cumulative effect of the various negatively operating factors is, at best, a slow rate of increase in output, rising total costs, and declining incomes due to growing pressure of population on land in traditional agriculture. Agriculture modernization on the other hand, gets underway through shifting production functions resulting in an increase in the productivity of resources already in use and also the development and substitution of supply elastic inputs for relatively supply inelastic traditional inputs. It is the consequent shifts in production possibilities and expansion in the ability to absorb productively a much greater quantity of inputs which most distinguishes modern agriculture from traditional agriculture.

The process of transition from traditional agriculture to modern agriculture essentially involves a dynamic interaction of the more or less self-contained subsistence agriculture with the modern factor market to get a continuous supply of non-conventional high-productivity inputs and with the product market to barter away the marginal increments in farm marketable surplus. An expanding role of the exchange economy makes farm decision makers increasingly rely on price signals

and information processes of the market. This is characterized by output response which depends not only on weather but also on the profitability of new inputs, which in turn, is dependent upon the cost of inputs and the prices of farm commodities being produced. The continuous shifts in farm productivity may, however, be fed by a stream of new inputs embodying new technical knowledge which pass through a complex of linkages of research stations, suppliers, and distributors in which marketing assumes an important role.

The allocation of farm inputs is, however, dependent upon the rates of return from different inputs and is subject to price variations in both factor and product markets. The intensity of interaction increases with the modernization of agriculture, as against subsistence agriculture which often operates in the role of a barter economy with a very limited use of cash. A small amount of marketable surplus does not significantly influence the functioning of very thinly connected embryo factor and product markets. Thus, agricultural development brings about complexity in interrelationships as well as internal growth of those markets. The process of change from simplicity to complexity, from static equilibrium to a dynamic one, and reorganization of the marketing system indicates that an important share of the difference in income levels among farming areas can be attributed to



conditions in input markets. Schultz very aptly remarks that:

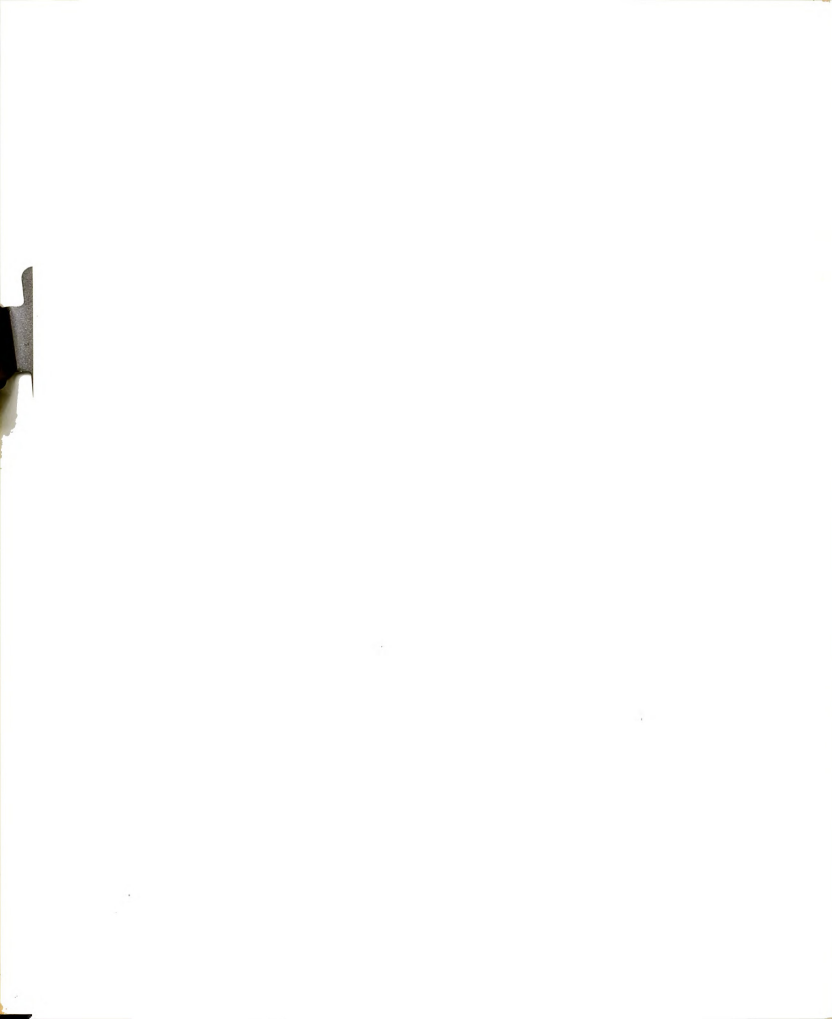
Economic growth from the agricultural sector of a poor country depends predominantly upon the availability and price of modern agricultural factors. The surplus of these factors in a very real sense hold that key to such growth.¹⁴

Once the process of modernization has been initiated, the supply of labor in a low-income agriculture becomes subject to moderately rising marginal cost with the assumption that there is no such labor which has zero marginal productivity. On the other hand, modern technology allows the substitution of relatively supply elastic inputs for labor and land the supply schedules of these modern reproducible material factors can, however, be made to shift downward by increasing the production capacity of farm input supply plants and through the development of cost-reducing technology. Thus, it is the interrelationships of shifting production functions and increasing input supplies which places great emphasis on the supply of new technical inputs in agricultural modernization.

Marketing and Economic Development

The marketing system can be described as a complex pattern of institutions and physical facilities which relate human beings and things in the transfer of goods

¹⁴Ibid., p. 123.

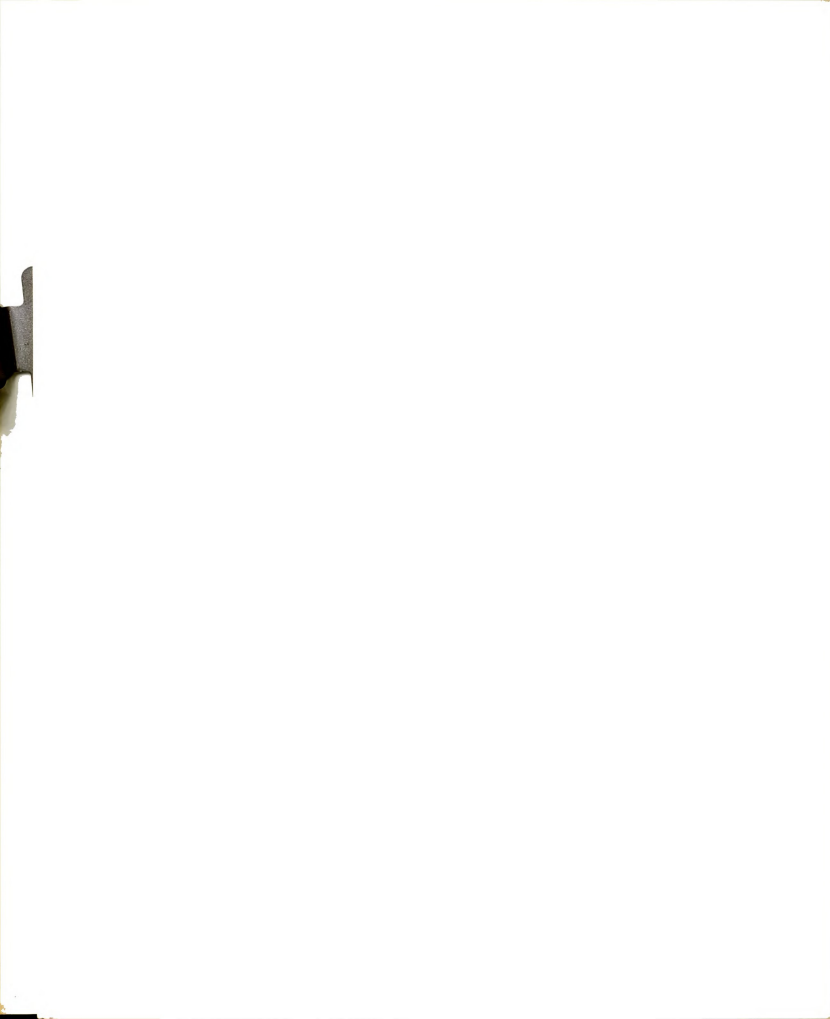


and services. A basic function of the marketing system is the effective transmission of consumer demand changes through the market channel to producers. Distortions in prices and related information flows through the exchange system can lead to under-utilization and misallocation of resources thereby limiting the overall supply response. Improvements in the distribution system may, therefore, reduce cost-increasing inflationary pressures that tend to originate from output supply inelasticities and institutional rigidities which are associated with the malfunctioning of factor markets and low mobility of resources in under-developed countries. According to Grunwald:

. . . this means roughly that the supply of goods and services does not expand and its composition does not adjust at a rate sufficient to meet not only a rising demand but also changes in the pattern of demand without serious price pressures.¹⁵

The exchange system and related market processes assume greater importance as a traditional agrarian society is transformed into a modern industrial society. The increased urbanization which accompanies economic growth increases the proportion of population dependent upon a system of commercial production and distribution. Changes in the demand plus a rapid population growth create additional pressures on the production and distribution system. Only a flexible system will be able to

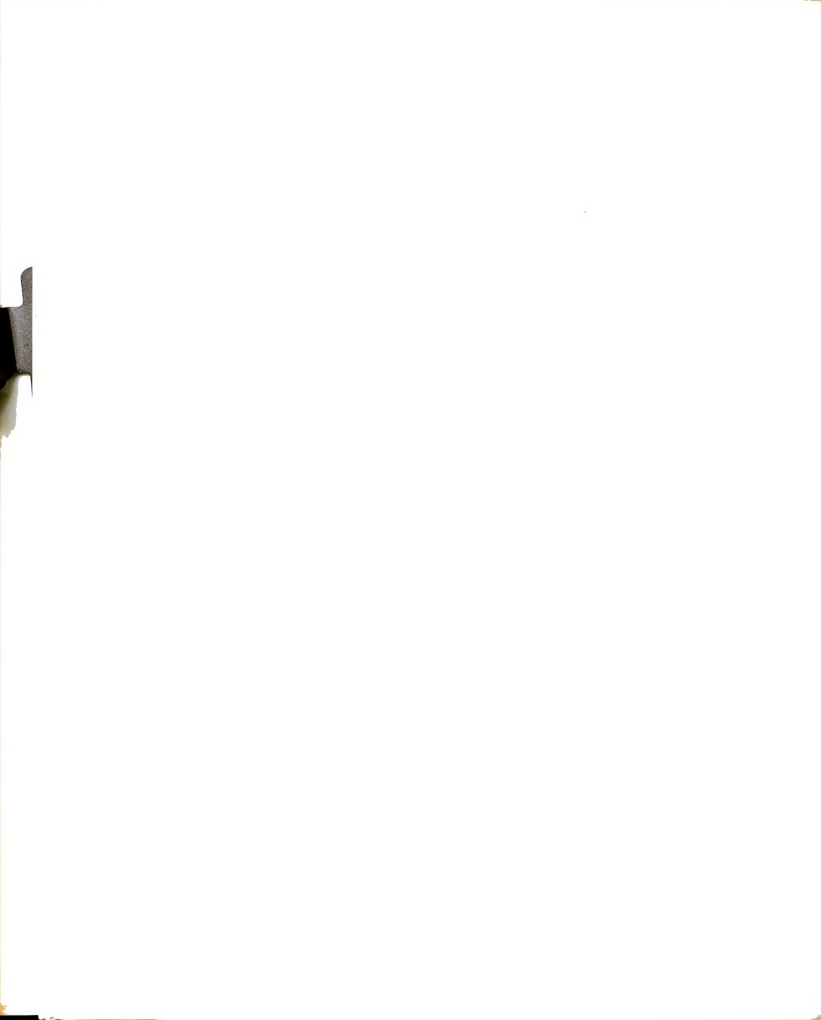
¹⁵ Richard H. Holton and John K. Gahbraith, Marketing Efficiency in Puerto Rico (Cambridge, Mass.: Harvard University Press, 1955).



respond to these demand changes, whereas the institutional rigidities of most developing countries prevent this degree of flexibility. Improvements in the distribution system would permit more responsiveness to demand changes and hence, relieve some of the inflationary pressures present in the food distribution system of these countries.

W. W. Rostow observed these structural changes taking place in developing countries and noted the serious distortions that have appeared, because of failures in the marketing system for food and non-food products. One of these distortions is the existence of import-substituting industries producing consumer goods for rich urban classes.¹⁶ The characteristic small size of these markets which grow slowly do not attract new capital for expansion, causing industrial growth to slow down after its initial take-off. Another distortion is the widening gap between urban and rural income, because of slower growth rate in the agricultural sector. Such an income gap provides incentives for large-scale migration from rural to urban sectors, can help correct structural distortions, and create a self-reinforcing process of agricultural and industrial expansion. The critical sequence of events which can induce market development consists of several steps which may be seen schematically for the three interrelated

¹⁶W. W. Rostow, View From the Seventh Floor (New York: Harper and Row, 1964).



sectors (urban food distribution, urban industrial production, and rural production). Thus a balanced development effort becomes necessary in view of the intersectoral relationships between agriculture and non-agriculture.

J. C. Abbot set down the following conditions needed for market demand to exercise its full incentive effect on production:¹⁷

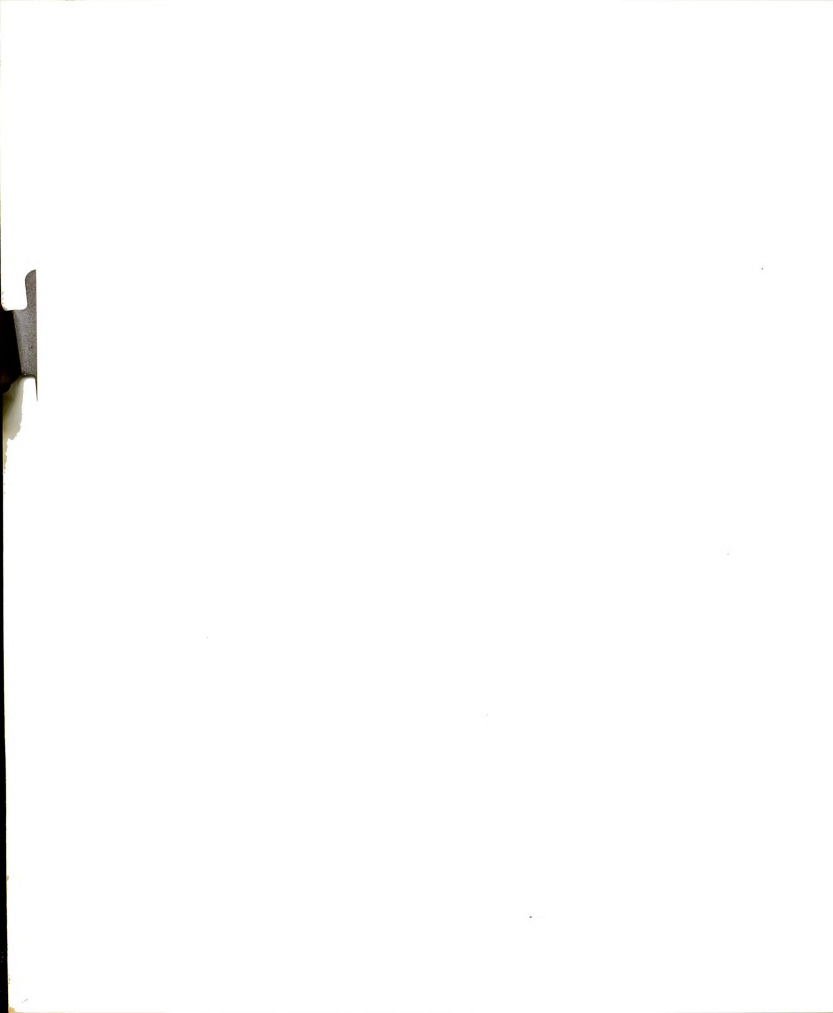
1. Reasonably stable prices, i.e., without discontinuous intra- or inter-seasonal changes, at a remunerative level. Unless farmers have confidence that prices will bear some minimum relationship to costs, they will hesitate before incurring additional work or expense to increase their output or raise its quality.

2. Adequate market channels and facilities. The marketing system should insure that growing urban demand, stabilized prices, and differentials for quality at the processing or consuming level are actually reflected in profit incentives to the producer and not lost in the route.

Operation of Factor Markets

The process of transformation of traditional agriculture essentially involves the introduction of a new factor of production which has a two-fold effect in bringing about a shift in the structure of relative prices in

¹⁷J. C. Abbot, "The Role of Marketing in the Development of Backward Agricultural Economies," Journal of Farm Economics, XLIV (May, 1962).



the product and factor markets. The immediate effect of the use of this non-conventional input will, therefore, be to increase farm productivity that will tend to alter the price ratios of different agricultural products. Since, development is not proportional to the increase in the output of all agricultural commodities, the products that did not enjoy an increase in farm productivity will find that their relative prices increased substantially. A rightward shift in the supply function of the individual farm commodity will lead to a resource transfer from the agricultural sector to the non-agricultural sectors, because of a disequilibrium between the farm and non-farm prices and emergence of newly unemployed or underemployed resources which may have a higher opportunity cost in non-agricultural sectors. The adverse terms of trade for agriculture may arise, because of a dramatic increase in the marketable surplus, the inherently competitive structure of agriculture itself and a whole range of public policy measures that may aim at diffusing the benefits of new technology to urban consumers at large. Questions related to the farmer, urban consumer interests, and price policy will be discussed later.

A similar shift may occur in the input market, because of a change in the marginal productivities of given inputs. It will result in a rightward shift in the demand for new high productivity inputs, thereby, altering

the production plans of farmers, effecting a shift in farmers' reinvestment coefficient, raising farm income, and bringing about a change in the consumption habits and saving patterns of farmers. Given the assumptions of perfect knowledge, rational decision-making, and farmers' expectations about the future, they will maximize their outputs by equating the marginal rates of return from various farm inputs. From an individual farmer's point of view, it would represent a change in the distribution of economic effort and in the mix of his total product. The extent to which the demand for new input will expand depends upon the output and substitution effects arising from its relative price change. In addition, it will depend upon the availability of substitute and complementary inputs, the output elasticity of new input for the production of a particular crop, and price elasticity of demand for that commodity. Cost-price relationships in the production of various farm commodities determine the amount of resources that a farmer will be willing to allocate. Generally, low levels of price elasticities of demand for agricultural output are likely to be reflected in declining prices yielding lower returns to farmers, unless some price support system is evolved, export outlets are sought, alternative uses of the surplus farm commodities are found out, or measures are taken to reduce the costs of input supply and attain input conversion efficiency.



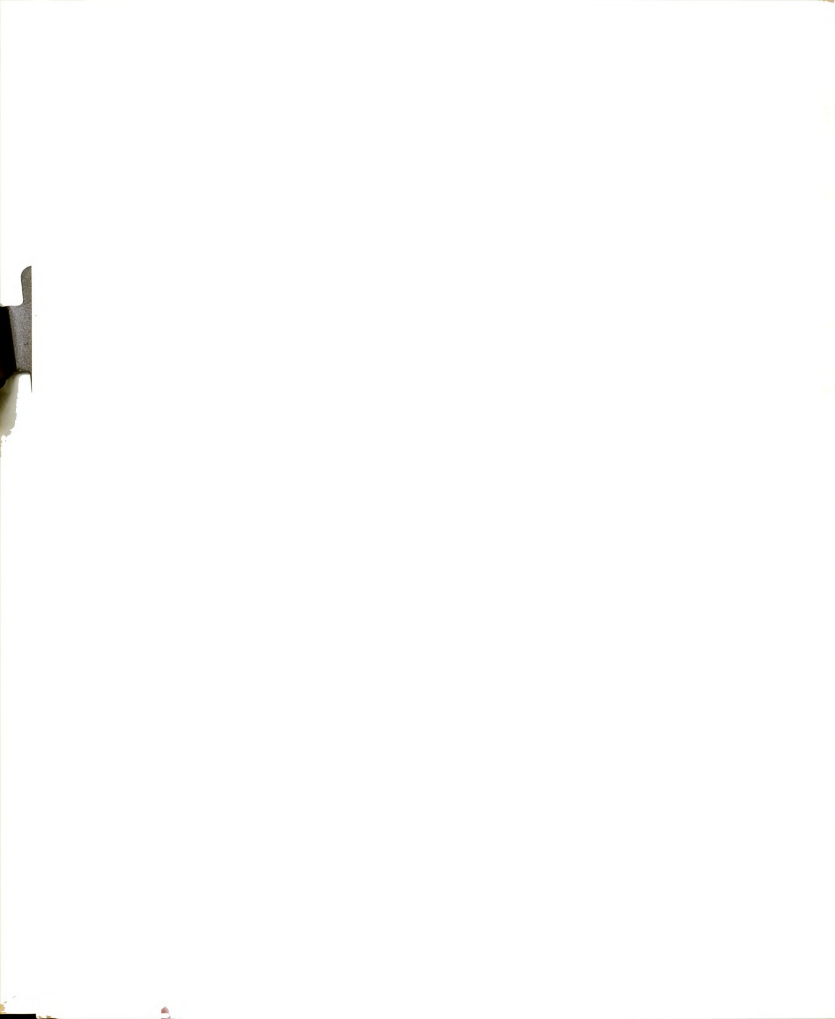
The technological change in the form of development of new inputs is unlikely to shift production functions and cost schedules for all crops equally. Thus, one of the concomittants of rapid technological change is the alteration in cost-relationships and consequent changes in relative levels of production and prices. Technical change in factor markets, on the other hand, tends to increase the efficiency of input use by raising the profitability of a given input. Under given demand conditions, the benefits of new technology will result in increased yields, rising farm income, an increase in the attractiveness of investment, and an enlarged pool of capital. The benefits of new technology will be in proportion to total production and not in proportion to gross level of increase in marketings. Thus, the benefits of new technology will be diffused equally between the lower income and higher income cultivator. If the market price drops somewhat, in response to increased production, the proportional effect of this technical change in raising real income would be greater for the lower income cultivator than for the higher income cultivator. In a similar context, Boulding having reviewed the United States experience, concludes that American success in combining a great investment in increasing productivity with a spectacular decline in the proportion of labor force in agriculture depends "on a



curiously perverse reaction to adversity."¹⁸ He concludes that other countries might not be able to rely on such an insensitive instrument as the price system to achieve an acceptable combination of these resources.

An important component of input markets in low income countries is the restraining influence of inadequate supply of capital on agricultural development. Increases in supply of capital are, therefore, likely to enlarge the rural market for farm inputs and industrial goods. It can help augment farmers' credit reserves, accelerate the rate of capital formation in agriculture, effect a change in the structure of farm organization, raise farm income, increase labor returns in agriculture, and consequently enhance the contribution of agriculture to gross national product. Returns from a unit of capital invested in agriculture may be very low, if the farm investors are already optimizing the use of old inputs. The rate of return to capital will be favorable, if a constant stream of low-priced and more productive new inputs continues to improve farm investors' profit functions. Whether there will be capital flight from agricultural sector to the industrial sector or vice-versa, depends upon the relative shares of return in both sectors and the environment of risk, uncertainty and price patterns for

¹⁸K. E. Boulding and P. Singh, "The Price Structure in Economic Development," American Economic Review (September, 1957).



agricultural and industrial goods. It is quite possible that investment priorities may shift from one sector to the other from time to time involving the movement of capital back and forth between the agricultural and industrial sectors. Schultz, however, argues convincingly that if the investments in agriculture change the form of capital used and are accompanied by massive investments in the human agent, the pay-off frequently might be handsome.¹⁹

In the adoption of new inputs a variation in the mix of inputs used is constrained by the limitation of capital which tends to magnify the tendency for new inputs to be used inefficiently. On the aggregate level, imperfections in the input markets and limitations in the availability of capital tend to produce structural disequilibrium in low-income countries. This has resulted in some undesirable consequences in the form of inefficiency in resource use and untapped production potential which has both its private and social costs. Since the production plans and decision-making processes of the farmer are dependent upon the environment for risk and uncertainty, the costs of borrowing credit and the rates of return available to it become important for the individual farmer. The high cost of credit tends to reduce

¹⁹Schultz, Transformation of Traditional Agriculture, pp. 100-25.



the profitability of a new input and thus, inhibits the diffusion of new technology. On the other hand, external credit rationing exists through the terms and cost of borrowing money and the environment for farm investment. In a low-income agricultural based economy where the relative proportion of farm products to the gross national product tends to be high, the social returns are believed to be greater than private returns to a unit of capital invested in agriculture, it would therefore be desirable to provide credit at subsidized rates.

The process through which an individual farmer will vary the use of a given input F , say fertilizer, with an extra limitation of credit can be illustrated by the following diagram:

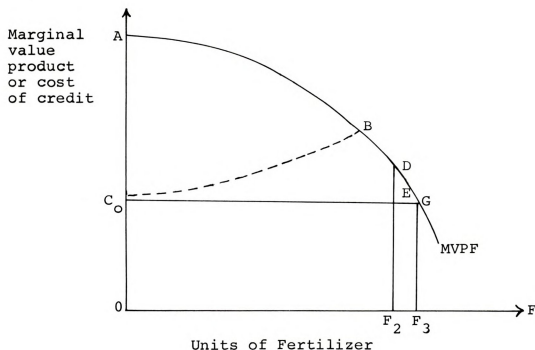
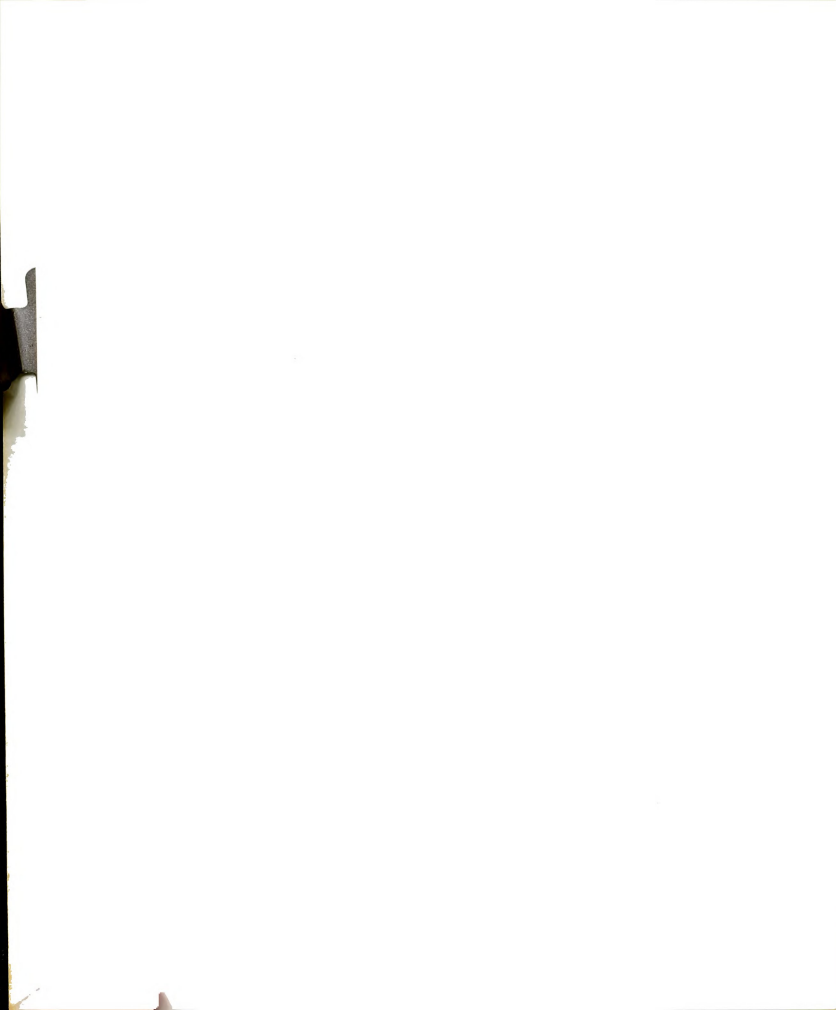


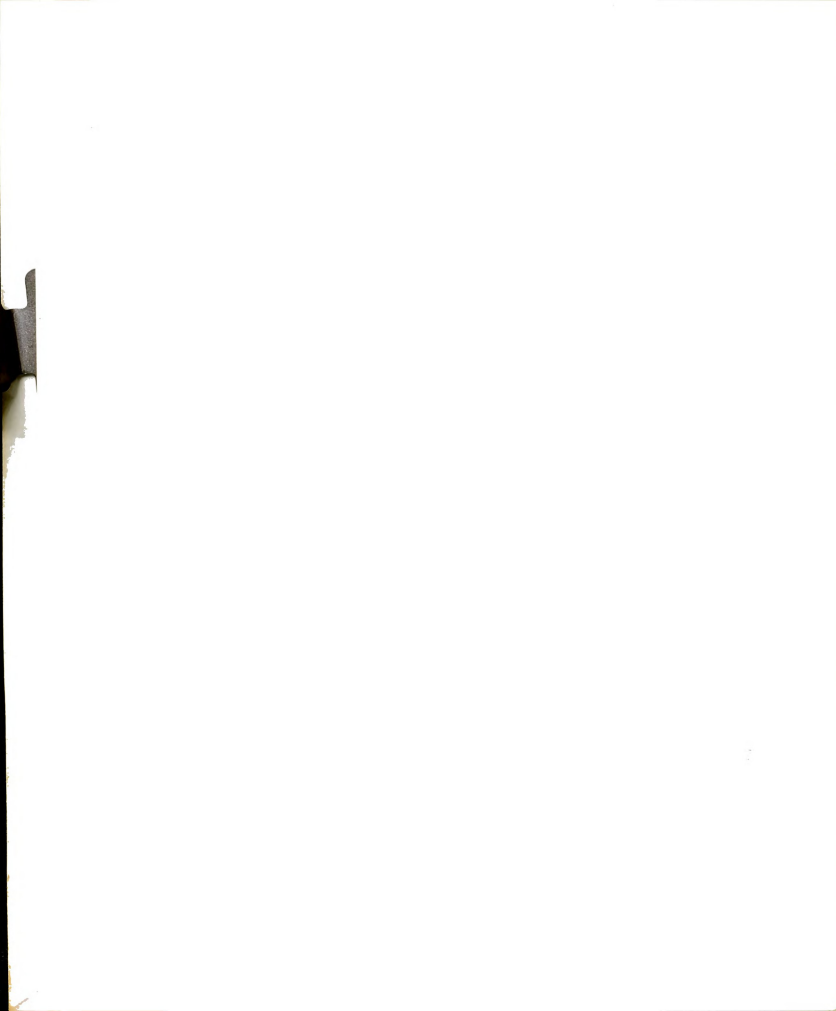
Figure 2.1. Credit-Constrained Optima in the Use of Fertilizer.



The use of fertilizer by an individual farmer yields increments to returns as depicted by the height of marginal value product curve MVPF and is priced at the purely competitive level of C_0 . If we relax the constraint of credit on the purchase of fertilizer, the farm producer will maximize his returns above the cost of fertilizer, by equalizing the cost of a unit of fertilizer with the marginal value product at the fertilizer use level F_3 . At this level, the returns to the farm producer over and above the variable costs are represented by the area enclosed by C_0AG where the variable cost of fertilizer to a use level of F_3 is represented by OC_0GF_3 and the total revenues generated for fertilizer use to this level are depicted by $OAGF_3$. It is assumed, however, that the supply of credit is perfectly elastic at a given rate of interest so that the supply curve of capital is identical with C_0G . Under the assumption of external credit rationing, if we impose a restraint on the individual farmer that he has only a limited access to the purchase of fertilizer, because of the availability of a limited amount of credit. The effect will be to reduce the use of fertilizer from OF_3 to OF_2 and net earnings to the farmer to the amount represented by the area enclosed by C_0ADE . The limited access to capital would tend to raise the supply cost of capital, because of the existence of excess demand generated by the triangle EDG which represents the farmer's



potentiality to increase his total returns by increasing the use of fertilizer. The cost of purchasing additional units of fertilizer to increase total net earnings rises because of the rising cost of capital that he faces. It is speculated that under the principle of "increasing risk," the effective cost of adding more and more units of capital increases, if the capital is borrowed. This is because of the fact that the rising proportion of borrowed capital to the amount of capital available to a farmer leads to a threat to his equity. In other words, the real cost of an unfavorable error in estimating the future exceeds the gains in real terms from a favorable error. Thus, the value of credit can be estimated in terms of its protective or productive contribution to the producing system. The protection cost of credit is the cost foregone by making an alternative use of credit, instead of using it as a safeguard against contingencies. Whereas, the production cost of credit represents the returns that would be gained by making an alternative use of credit for investment. Thus, the rising marginal input cost curve C_{OB} slopes upward at rates that differ among inputs bought with borrowed funds and the rate of absorption of credit reserves. For those inputs which have a higher marginal value product and can absorb the farmer's credit reserves more rapidly, the marginal input expense curve will be more steeply sloped than for those inputs which absorb credit reserves slowly.



In contrast to the product markets, which have a long history of evolution, the organization of factor markets for supplying the new technology-embodied inputs is relatively new and rudimentary in low-income countries. The existing market environment in and around agriculture neither encourages farmers to produce more, nor to market much of what they produce. The essential change in market-building is to increase the interaction of product and factor markets by enhancing the proportion of farm output flowing to urban consumers and expanding the market of off-farm produced inputs for farmers. Such supply and demand induced changes in the input market can lead to product mix changes and can trigger a self-reinforcing advance in the value of farm output.

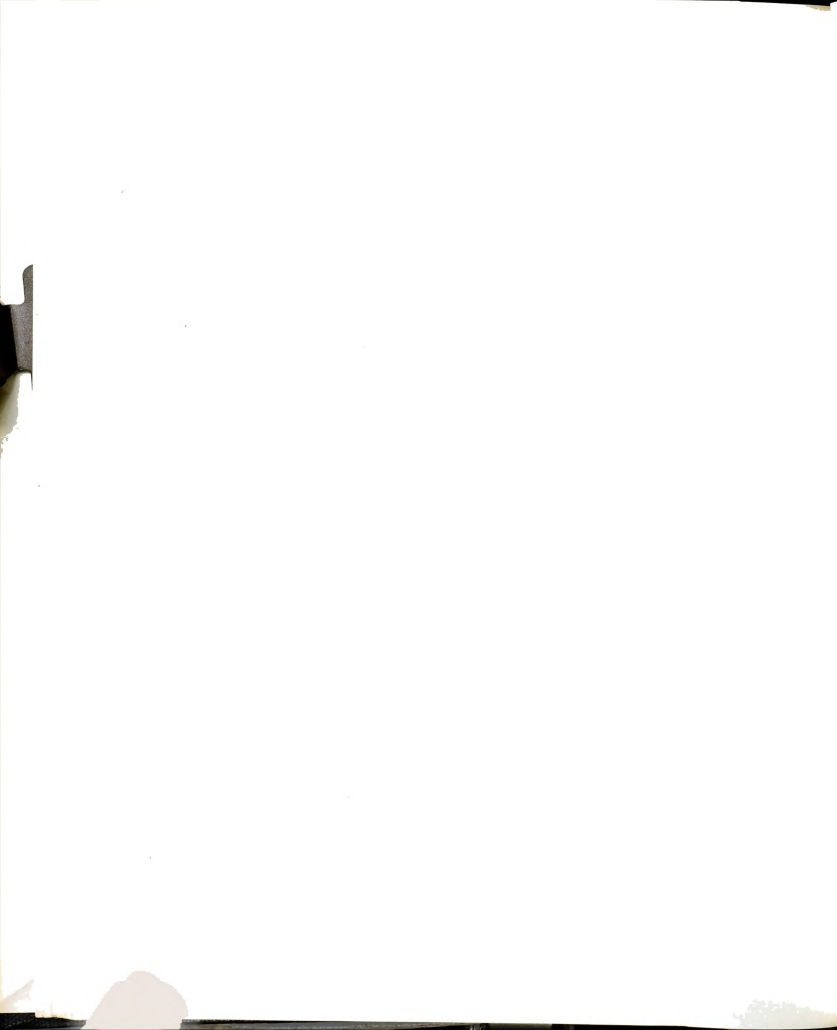
Since the introduction of a new factor of production into traditional market structures calls for reorganization and streamlining of market operation, a modern marketing system aiming at renovation of the existing market structure would, therefore, require flexibility as an additional characteristic of the system in order to handle an ever-increasing volume of farm inputs and crop output. An identification of the economic interrelationships in terms of prices and physical flows of fertilizer, market risks, and uncertainties perceived by channel operators would be necessary. Measures to improve the market performance and reduction of risk and uncertainty may be undertaken through a "package" of reforms which vary in



composition and intensity in accordance with the system and results desired by the society.

Risk and uncertainty may arise in the marketing system due to prices, supplies of products, factors of production, and poor market coordination throughout the stages of market channel. While internal coordination may be managed through administrative action within the marketing firm, external coordination may be accomplished through the action of prices, markets, and other forces that govern relationships between firms. Internal coordination may very well be achieved through vertical integration of the various steps of production within the firm.²⁰ Larson's thesis focuses considerable attention upon ways of improving the external coordination in the product and factor markets so as to reduce the overall level of risk and uncertainty. The fact that the existence of risk and uncertainty can lead to sub-optimal allocation of resources is attested to by D. Gale Johnson in the following statement, "in the short-run uncertainty results in less than the optimum combination of resources within the firm, while the long-run effect of uncertainty is the rationing of resources to less than optimum size of

²⁰Donald Larson, "A Diagnosis of Product and Factor Market Coordination in the Bean Industry of Northeast Brazil" (unpublished Ph.D. dissertation, Michigan State University, 1968).



firm."²¹ The risk reduction can, however, lead to an increase in the profit expectations of marketing firms so that new resources are attracted into the system thereby increasing its output and productivity.

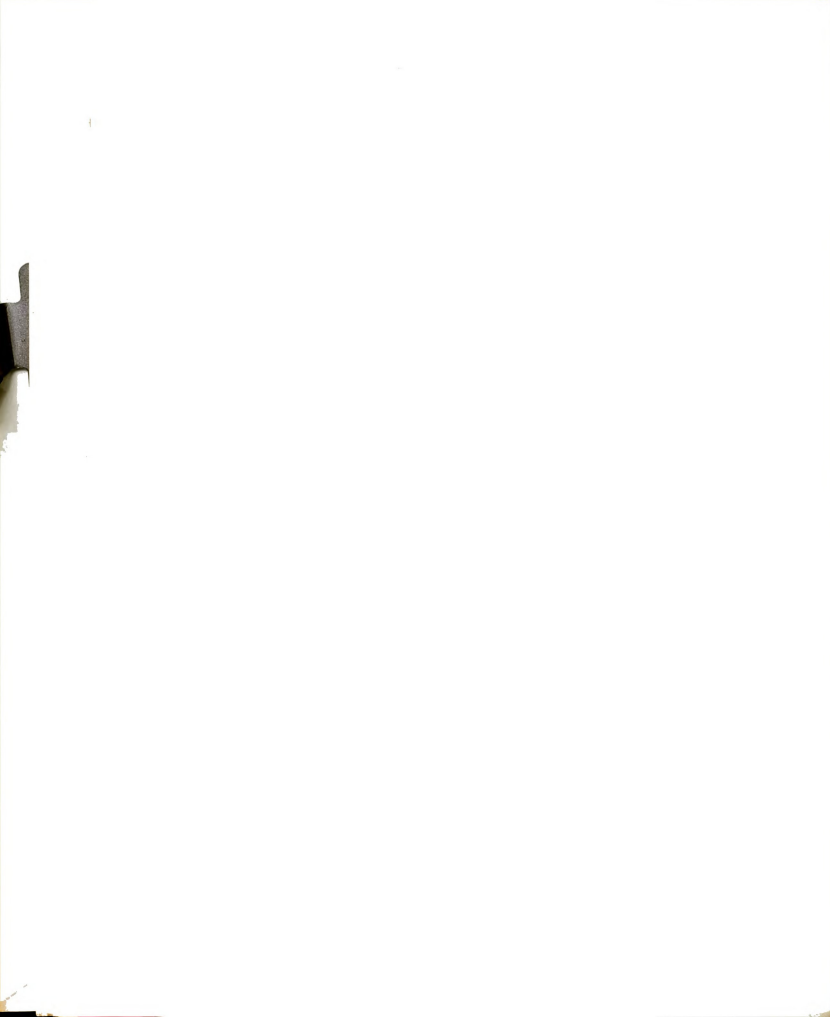
In the initial stages of input market development the administrative, organizational, and capital problems of production and distribution of new inputs may lead to an excess of demand over supply, thereby creating difficult educational problems of establishing priorities as to where the scarce inputs are to be directed. The stage of agricultural transformation of a country would determine the extent to which new factors of production are to be capital intensive or labor intensive, and also the intensity and level of demand for these inputs. The rate of investment in agriculture would, however, depend on the relative discounted rate of return for farm and non-farm sectors. An agricultural development strategy that aims at generating an initial outflow of capital from agriculture into input supplying industries and a subsequent inflow of capital to intensify the use of modern inputs as well as optimal utilization of investment opportunities at the farm level under given consumption and saving patterns would seem desirable.

²¹D. Gale Johnson, Forward Prices for Agriculture (Chicago: University of Chicago Press, 1947).



A necessary adjunct of the development of factor market institutions is the creation of adequate supportive infra-structure in order to generate a continuous stream of modern inputs which could be provided to the peasant farmer at the required time, place, and incentive price. Technical assistance is needed to generate information flows for the proper use of new inputs and a feedback system would be required to exact necessary improvements in the quality of technical inputs and to support "adaptive" research.

An elaborate credit program may be built up to meet the loan requirements at a reasonable rate of interest and in a supervised form to make it more effective. Gradual commercialization of agriculture is likely to bring about more and more specialization in farm production and a rapid growth in demand for credit as well as other farm inputs. Existence of complementarities among the inputs and their varied characteristics are likely to lead to the emergence of specialized input supplying and distribution agencies. It may create the need for a specialized extension organization in order to effectively diffuse the technical knowledge concerning the use of individual inputs. It will give the required dynamism to input supplying firms, give rise to the economies of scale, and simplify the process of tackling problems arising from the side effects of new technology. Technological back-stopping also grows in importance as the production



system becomes more technologically advanced. In this framework, the market would be required to function in the context of social efficiency so as to serve as a convenient means of making contributions to welfare while siphoning off large portions of the social product. A whole range of policy measures may be used so as to redistribute the benefits of change and innovation among farm producers and urban consumers.

The process of agricultural development, however, requires a simultaneous and coordinated expansion of investments in production and marketing. Prices are the primary communication devices which can reflect most effectively the situation as it is and as it will be. The coordination of investment decisions depends importantly on the information about present plans and future conditions. Thus overall investment planning and administrative arrangements are necessary to supplement market prices as communication devices in coordinating production and marketing improvement programs.

Three important economic relationships that are necessary for the acceleration of agricultural development are as follows: (1) developing a system of efficient prices, (2) rewarding economic opportunities for farmers, and (3) providing the sources of such opportunities.

Whether a system of efficient price relationships is effective or not, depends to a large extent, upon how

well the marketing system performs. The single best coordinator between product and factor markets is the price as an exchange opportunity that can be brought to bear upon the stimulation of output. Under perfect market conditions, the exchange opportunity would represent a single price; in an imperfect market it will not describe a single, but a marginal exchange opportunity that is the rate at which small quantities of commodities can be exchanged.²²

Price Policy

Price policy is an important instrument that can help restructure the flow of resources from one commodity to another or to individually favored commodities through guaranteed prices or through raising the average level of prices. This controlling device would not be successful, if physical production ratios work strongly to the disadvantage of the crop to be encouraged. In such cases, underlying reasons for the structuring of free market prices and production patterns must be examined before any intervention to distort the existing price system can be made. Market determination of prices in less developed countries is beset with market restrictions, maximum or minimum prices, fixed grade price differentials, and inter-regional trading restrictions. The problem, therefore,

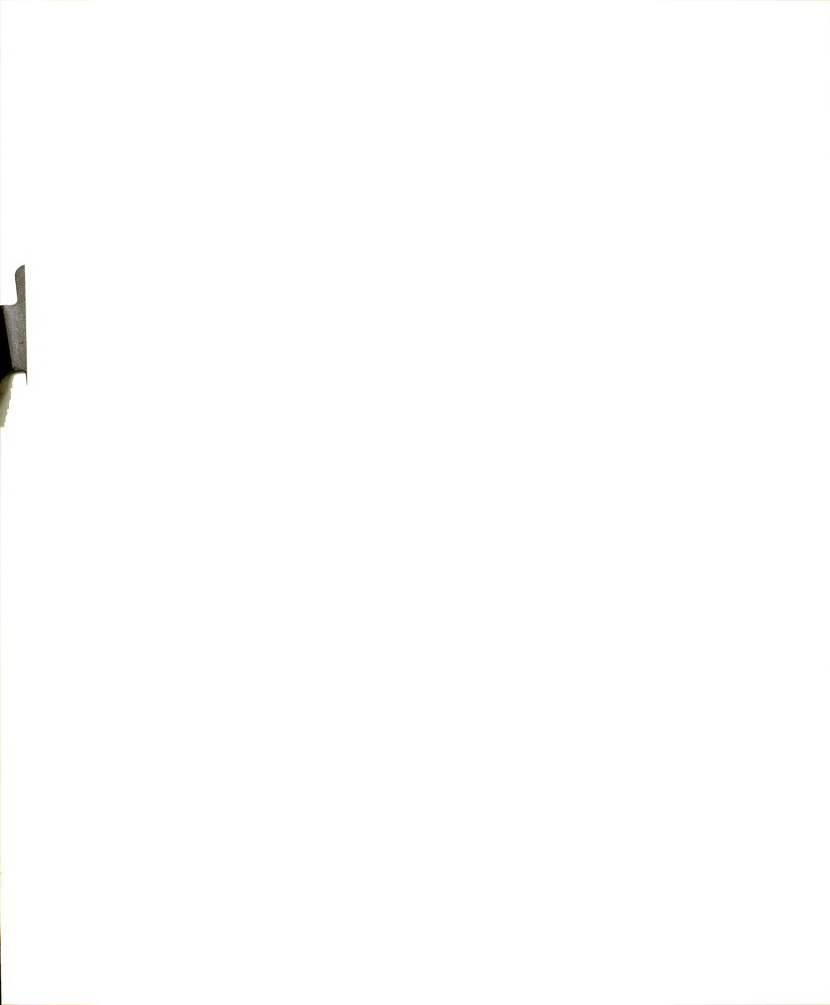
²²Boulding and Singh, "The Price Structure in Economic Development."

is not that intervention distorts prices away from their equilibrium levels, but it is how to distort the price system at the least cost for the stimulation of production. The least cost alternative that tends to maximize our objective function would be a better solution.

Changes in farm prices can be manipulated to facilitate the attainment of certain goals through the operation of one function, while operating against other simultaneously held goals. The three useful functions that farm prices can be expected to perform are delineated:

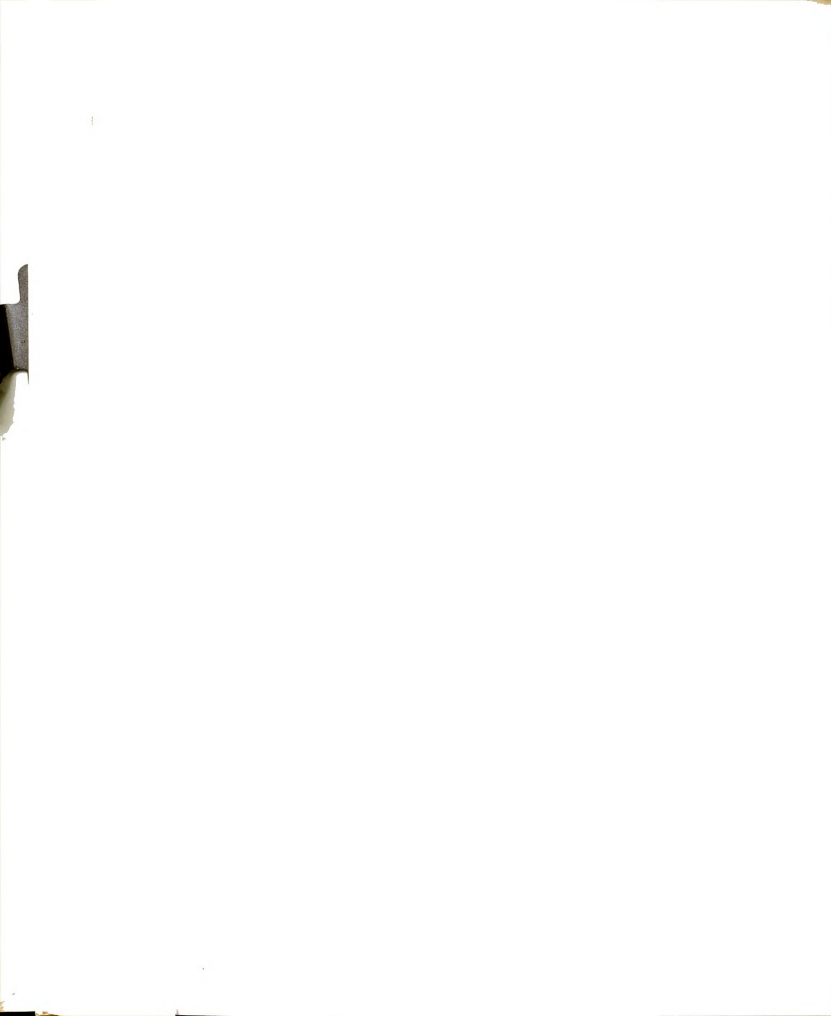
1. They can serve as allocator of resources and may signal to both producers and consumers concerning the conditions of farm production and consumption.
2. They can be used as an instrument to redistribute income.
3. They can influence the rate of capital formation.

As an allocator of resources, the relative rise in farm prices can be interpreted to encourage increased investment in the farm sector that may operate through two influences. They may increase the gross returns to investment proportionate to the price increase, if almost all of the output from increased investment is marketed. The second influence of higher farm prices on investment in agriculture may operate through the income effect and is in direct proportion to the latter. The income effect



tends to raise the saving coefficient and makes farmers a better credit risk. Change in farm prices does effect a transfer of income between the agricultural and non-agricultural sectors of the economy and redistributes income between high and low income persons. A rise in farm prices would tend to redistribute income away from low-income urban consumers towards high income farm producers. The extent to which urban consumers' relative real income will be affected by a given percentage rise in food prices would depend upon the proportion of their incomes spent on food. Thus, a low-income urban consumer with a relatively greater food budget is likely to be affected more by a given percentage rise in price. The usual classification of a lower income and higher income farm producer can be based on the amount of marketable surplus. Thus, for a given change in farm prices, a lower income farm producer with a smaller level of marketable surplus will be proportionally less affected than the higher income cultivator with a higher level of marketable surplus.

In isolation, the impact of price policy in enhancing the level of aggregate farm output is more or less palliative, its effect being capitalized into higher land prices, except for when it is accompanied by technological change in agriculture. As a matter of farm policy, the critical sequency of variables that can



effect a major shift in crop output, would be attained only through the introduction of a new technical input that can bring about a shift in crop production possibilities.

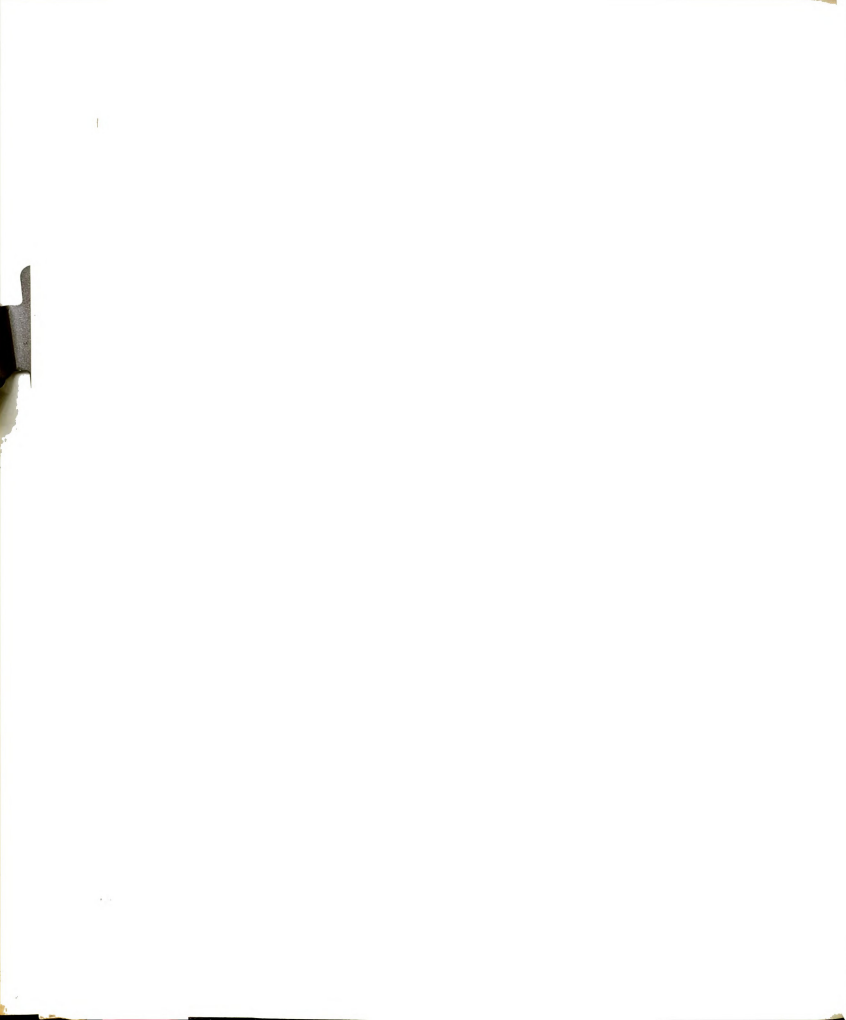
While higher farm prices are likely to increase the value of marginal product of farm inputs and consequently increase the rate of capital formation in agriculture. Conversely a low-price food policy is likely to reduce the cost of living of urban workers, encourage an outflow of capital from agriculture shift the level of saving in industrial sectors, and consequently, accelerate the rate of capital formation for industry.

In general, it is assumed that the demand for agricultural commodities is inelastic and that the price flexibility coefficients are greater than one. Decreases in agricultural production will, therefore, be accompanied by more than proportional increase in prices and by increased farm incomes. This reflects the usual pattern of output response in high income agriculturally developed countries. On the other hand, in a low income country, two factors work to reverse this relationship between production and income. First, the price elasticity of demand is much less inelastic in low-income countries. Indeed, the price elasticity of demand for all food may not be much "less" than minus one and even for food grains alone, it may be as "high" as -0.5 , and is, in any case, less inelastic than in high income countries. Second,



in low-income countries farmers who produce food crops, generally sell only a portion of what they produce and therefore, receive market price impact on only a portion of production. Suppose, on the average, farmers in a low-income country sell about 30 percent of what they produce. Given the magnitudes of price elasticity and the proportion of output marketed, real incomes of farmers would be directly related to production in sharp contrast to the inverse relationship in high income countries. It may be further assumed that marketable surplus directly varies with the changes in crop output. It can be concluded, therefore, when good weather brings increased production, real incomes of farmers rise and conversely, when weather is poor. Likewise, when technological change brings about increased production, incomes rise even without the effect of shifting demand schedules that accompany population growth and rising incomes.

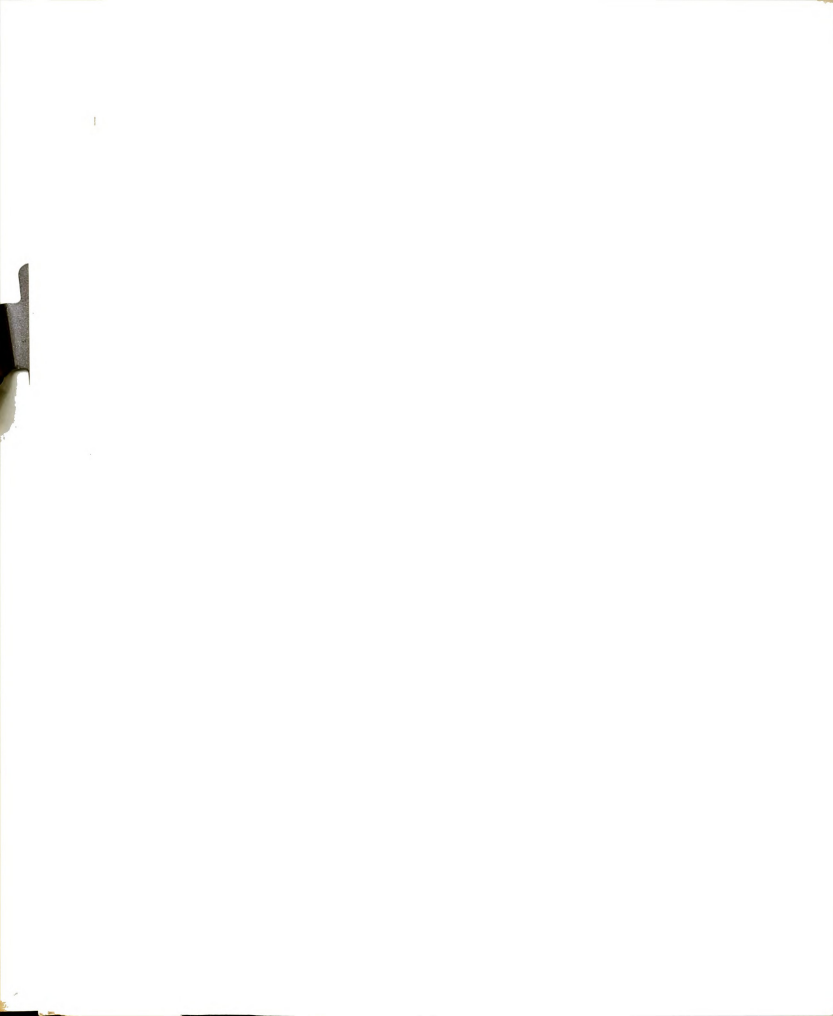
An increase in agricultural production is likely to increase national income affecting demand as well as savings and investment potentials. Price changes tend to redistribute additions to income between agricultural and non-agricultural sectors. The price elasticity of demand and marketing ratios in low-income countries are such that only a part of this increased income is distributed to the non-agricultural sector through price declines and a part remains in the agricultural sector. In the long-run, however, as distinct from the short-run



weather induced fluctuations, growth in population and urban derived incomes place a further upward pressure on agricultural prices favoring maintenance of an even higher proportion of the income from increased production in the agricultural sector. An estimation of the effects of changes in farm output on agricultural incomes would require a knowledge of the following variables:

1. The price flexibility coefficient.
2. The proportion of output marketed.
3. The change in the proportion of output marketed with respect to changes in production and consequent changes in prices.

Statistical evidence, on the operation of factor markets and the effects of agricultural price policy is very limited. On the other hand, an exploration of these areas of research is necessary if the operation of input markets is to be understood and a precision in price policy with awareness of the consequences is to be achieved.



CHAPTER III

SUPPLY AND DEMAND FOR FERTILIZERS

Introduction

The problem of market development and distribution of fertilizers is essentially the problem of channelling the quantity of fertilizers available through the pipeline to meet the rising demand. Whether the existing system of marketing is adequate or inadequate and what new directions it should take, depends to a large extent upon the structure and behavior of the forces of supply and demand. The purpose of this chapter, therefore, is to delineate various factors affecting the supply and demand conditions of fertilizers in West Pakistan. Agronomically, the demand tends to fluctuate with the sowing time of two major crop seasons of West Pakistan, i.e., Rabi (winter) and Kharif (summer). Whereas the supply is continuous as it passes through a variety of chemical processes and complex systems of production. The continuous flow is sustained through the year-round availability of raw materials from indigenous or external sources and an employable pool of labor.

Assuming a stable supply position of indigenously produced fertilizers, changes in the overall supply takes place because of variations in the quantity of imported fertilizers. Whether or not it will arrive in time depends upon the availability of such a scarce commodity as foreign exchange and the surplus capacity available from the exporting firms.

The extent of spatial variation in supply depends upon the location, size, and number of supply points as well as the location of fertilizer demand points and the intensity of demand, and also the efficiency of intra-market movement of fertilizers.

The demand for fertilizers in West Pakistan, as anywhere else, has the tendency to vary with the type of crop season, method of irrigation, level of farm income, liquidity position of the farmer, the pattern of economic incentives as well as the local availability of fertilizers to farmers. As a commodity of indirect consumption, the use of fertilizers requires technical knowledge and a time lag before desired crop output can be attained. Unlike fertilizer suppliers the demanders 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. Temporal changes in demand take place because of the seasonal pattern of fertilizer consumption. Spatial demand for fertilizers is determined by the availability of complementary inputs in different regions.

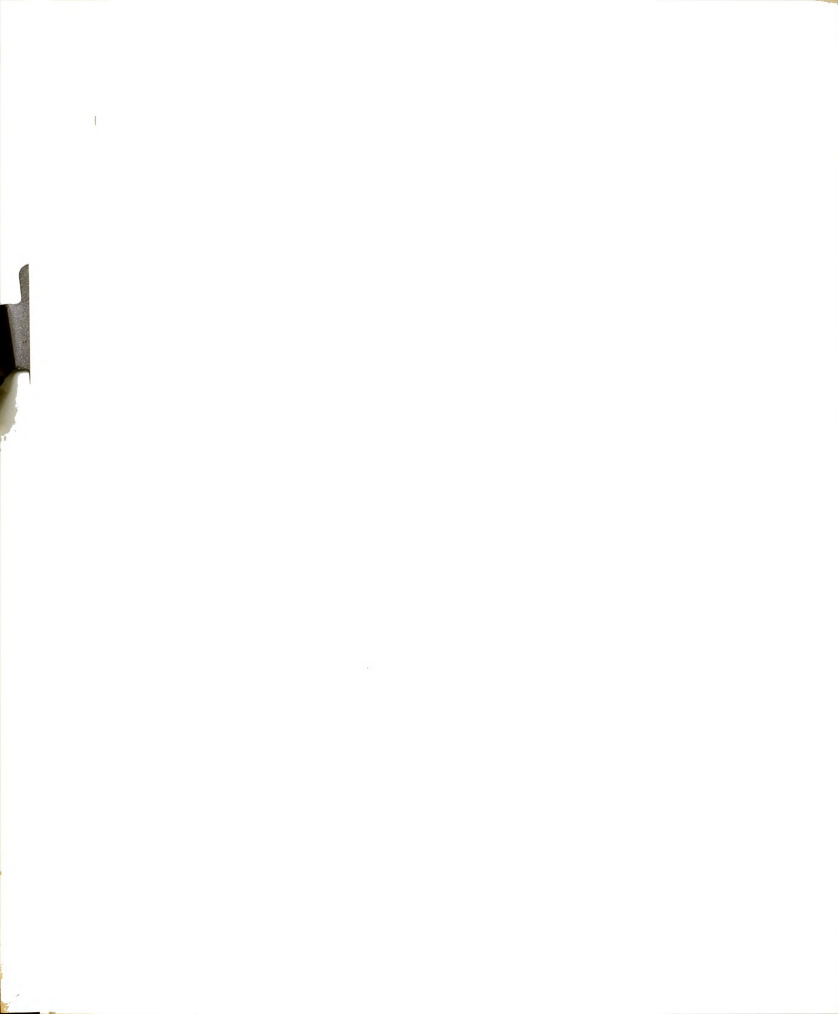
A Brief Overview of the History of
Fertilizer Use in West Pakistan

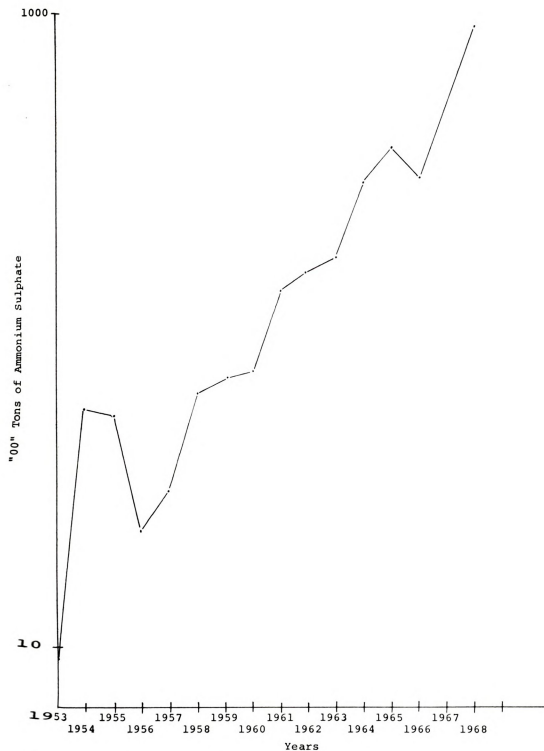
The economic history of fertilizer diffusion in West Pakistan tends to substantiate the fact that fertilizer use was both a matter of expediency and necessity to the government.

The post-independence period of 1947-51 witnessed a transition during which the Western Wing of Pakistan became food deficient from a food surplus region. It brought in its wake a continuously increasing dependence on food imports to meet the people's bare minimum calorie requirements as well as an increasing strain on the scarce foreign exchange resources of the country. The small foreign exchange resources of the country were placed under competing demands for financing the import of capital goods to accelerate the pace of industrialization as well as the cost of an increasing volume of food imports. Staple food, being the basic wage good, food shortages from time to time tended to escalate agricultural prices, thereby influencing the relative competitive position of Pakistan's agricultural exports in the world market. This brought about an early realization on the part of government concerning the use of modern inputs that could be

brought to bear upon the supply inelasticity of agricultural output, accelerate the food output, and reduce the foreign exchange cost of food imports. But it was not until 1952 that one thousand nutrient tons of nitrogenous fertilizers were distributed among the farmers by the Department of Agriculture in various regions of West Pakistan. An illustration of the fertilizer consumption history from 1952-53 to 1967-68 in terms of tons of ammonium sulphate is given in Figure 3.1.

Experimental work conducted on fertilizer use indicated a general deficiency of nitrogen in the soils of West Pakistan and the recommendations that were made available to farmers were simply broad-based and related mostly to the application of nitrogen alone. It was presumably thought that the soils of West Pakistan are adequately provided with phosphorous and potash nutrients so as to meet nutrient requirement of different crops and that the application of a single nutrient could bring about immediate returns to farmers' investment. The continuous use and an unbalanced dose of nitrogenous fertilizers led to a steady removal of complementary soil nutrients such as phosphates. It was by the year 1959-60 that one hundred thousand nutrient tons of phosphates were consumed in West Pakistan. Persistent reliance still tends to continue on the existing potash resources in the soil to support an increasing level of crop production and with





Source: Government of West Pakistan, Statistical Handbook of West Pakistan (Lahore: Bureau of Statistics, Planning and Development Department, 1967).

Figure 3.1. The Pattern of Growth in Fertilizer Use in West Pakistan (1953-68).



still more expectations of even higher farm productivity. Since no specific survey has been conducted to determine the nutrient requirement of different soils, the optimum dose of fertilizer may differ from area to area. Until now, the use of fertilizer has continued on a blanket recommendation in terms of bags of fertilizers instead of nutrients regardless of the improvement in soil-water-crop management systems. Fertilizer consumption received an extra impetus during the second five year plan, partly because of the increased availability of chemical fertilizer and its complementary inputs to the farmers and partly because of a strong governmental drive to achieve food self sufficiency and in addition, due to the increased realization on the part of farmers about the benefits of this technology.

Supply of Fertilizers

The amount of fertilizer that will be available during a particular year in West Pakistan depends upon the quantity of fertilizer produced by indigenous plants and the magnitude of imported fertilizers.

$$S_f = D_f + I_f$$

S_f = Total["] supply of fertilizers during a given year.

D_f = Quantity supplied of the indigenously produced fertilizer.

I_f = The amount of imported fertilizer during a given year.



Since the supply of indigenously produced fertilizers tends to remain perfectly inelastic during a given production year, the equilibrium price (P_e) will be determined by the intersection of domestic supply curve SS with the demand for fertilizers DD at the point A. It may be assumed that the free market price of fertilizers is too high for the purchasing power of an average farmer and that it reduces farmers' profit expectations from the use of fertilizer. A subsidized price of fertilizers will, therefore, be necessary for market expansion and to improve farmers' expected rate return from their investments. Suppose that the government provides subsidy to effect a reduction in the equilibrium price of fertilizers to the extent of AC, the supply price of fertilizers will, therefore, be P_s (see Figure 3.2). It may be further assumed that the government meets the deficiency in the overall supply of fertilizers by imports so that the new market equilibrium gets established at B with equilibrium price being P_s . The subsidized price will induce increased fertilizer consumption and effect a change in the quantity of fertilizers purchased to the extent of CB which just equals the deficit in the domestic supply of fertilizers.

If we relax the assumption of fixity in the domestic supply of fertilizers and assume that the technologically fixed supply of fertilizers can be changed over a long period of time through the erection of new plants



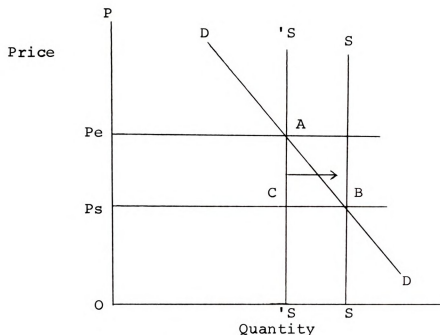


Figure 3.2. Adjustment of Fertilizer Supply and Demand at Subsidized Price.

or through the expansion of production capacity of existing plants, the fertilizer supply curve will be positively sloping.

Indigenous Fertilizer Production

The decision whether to meet the domestic demand for fertilizer by indigenous production or through a continual reliance on fertilizer imports will depend upon a number of factors.

1. A fundamental comparison which can be made is to establish whether the cost of freight and handling the imported fertilizer outweighs



the difference in operating costs between exporting countries and Pakistan.

2. The effectiveness of investment in fertilizer industry in saving or earning foreign exchange.
3. The availability of indigenous or imported cheaper raw materials for feeding a domestic fertilizer industry.

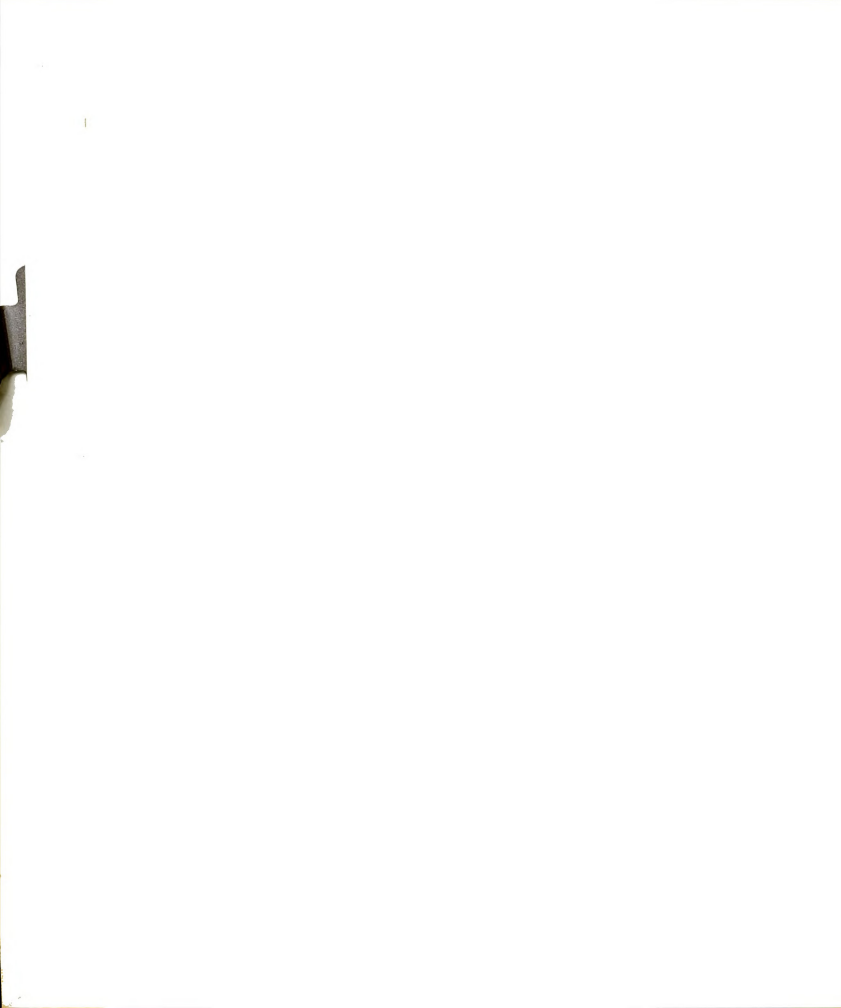
One single factor that tends invariably to favor the indigenous production of fertilizers is foreign exchange. As a scarce resource, foreign exchange is an asset to the development of Pakistan's economy, because of its multiple alternative uses and high shadow prices. It is needed for the import of capital goods, consumer durables, spare parts, and industrial raw materials. Whether or not Pakistan can restructure its resources so as to optimally utilize them is constrained by the availability of foreign exchange. Pakistan's international trade statistics indicate that it has almost continuously faced an adverse balance of trade with its attendant problems of dependence on foreign aid and an over valued currency. The production possibilities generated by existing resource endowment have little chances of making any major increases in the foreign exchange earnings so as to meet the import requirements of the country.



A continuous dependence on fertilizer imports would imply a recurring expenditure of high opportunity cost resources which will be subject to variations in keeping with the behavior of international fertilizer market and availability of such a volatile element as foreign aid. How far the investment in indigenous fertilizer production will effect a saving in the foreign exchange earnings hinges on the availability of raw materials within the country, the amount of foreign exchange required to finance the capital costs of a fertilizer plant and the foreign exchange needed to finance the recurring costs. Since industrial countries are more frequently able to take advantage of the most recent technological changes, economies of size and scale, intensity of demand and size of the market, the capital costs of erecting a fertilizer plant will be higher by about 20 percent in a developing country than in a developed country. Available statistical evidence indicates that the investment costs of erecting a nitrogenous fertilizer plant in Pakistan are higher by about 30 percent as compared to developed countries and foreign exchange component of the capital costs would constitute 60 percent.²³

Given a lead time of three to five years in fertilizer plant construction, imports may be the only

²³Emile C. Freeland and Clyde S. Adams, Fertilizer Statistics and Recent Developments, U.S. AID, Karachi, 1965, pp. 1-25.



solution in the short run. An optimal rate of fertilizer importation in terms of the overall economy will depend on Pakistan's export capability, availability of foreign aid, and the net inflow of private investment. In spite of the domestic production of fertilizers based on indigenous reserves of natural gas, the fertilizer industry will require a high direct and indirect foreign exchange component. Soligo et al. emphasize that "a fertilizer industry in Pakistan, currently based on natural gas still requires the importation of inputs equal to about 5 percent of the total value of output."²⁴

Though the results of soil tests throughout West Pakistan reveal a serious lack of nitrogen, phosphorous, and organic matter, of all the three plant nutrients more nitrogen is used than either phosphorous and potassium. Nitrogen production also requires more investment than either of the others. About 98 percent of all nitrogenous fertilizers are made with ammonia which, in turn, are made from natural gas by a chemical combination of hydrogen and nitrogen through a process known as steam reforming. West Pakistan is endowed with relatively abundant reserves of natural gas estimated to be around 16,080 billion cft, whereas the domestic consumption of this gas was only

²⁴ Soligo et al., "Economics of Ammonia Production in Developing Countries" (paper presented at the Inter-regional Conference on the Development of Petro-Chemical Industries in Developing Countries, Center of Industrial Development, New York, United Nations, 1964).



276 billion cft in 1964.²⁵ The major single use of this gas has been made in power generation and as an industrial fuel. Very limited use of it has been made as a raw material for the industry except for the production of nitrogenous fertilizers at Multan. Since Pakistan has sufficient reserves of natural gas with almost no reserves of potash and phosphates, it will be advisable for Pakistan to rely on alternative sources of power and divert a greater percentage of natural gas for the production of nitrogenous fertilizers, apart from naphtha which can be obtained from local refineries.

One of the objectives of the development of the fertilizer industry in a developing country like Pakistan is the transference of technical skills and provision of employment to the local labor. It has been estimated that three skilled and five unskilled persons are required for each thousand tons of nutrients that are produced and distributed per year. In spite of the capital intensity of the fertilizer industry, an average fertilizer plant that produces 1000 nutrient tons of fertilizer per day and operates for 300 working days in a year is estimated to provide employment for 2400 individuals. An interesting feature of the fertilizer industry is the rapid rate of

²⁵ Government of Pakistan, Planning Commission, The Third Five Year Plan (1965-70), June, 1964, pp. 110-15.



technological change which has resulted in low fertilizer prices to the farmer. Available price data indicate that in the United States fertilizer prices declined by one-half relative to those for farm products during the decade from 1939-40 to 1950.²⁶

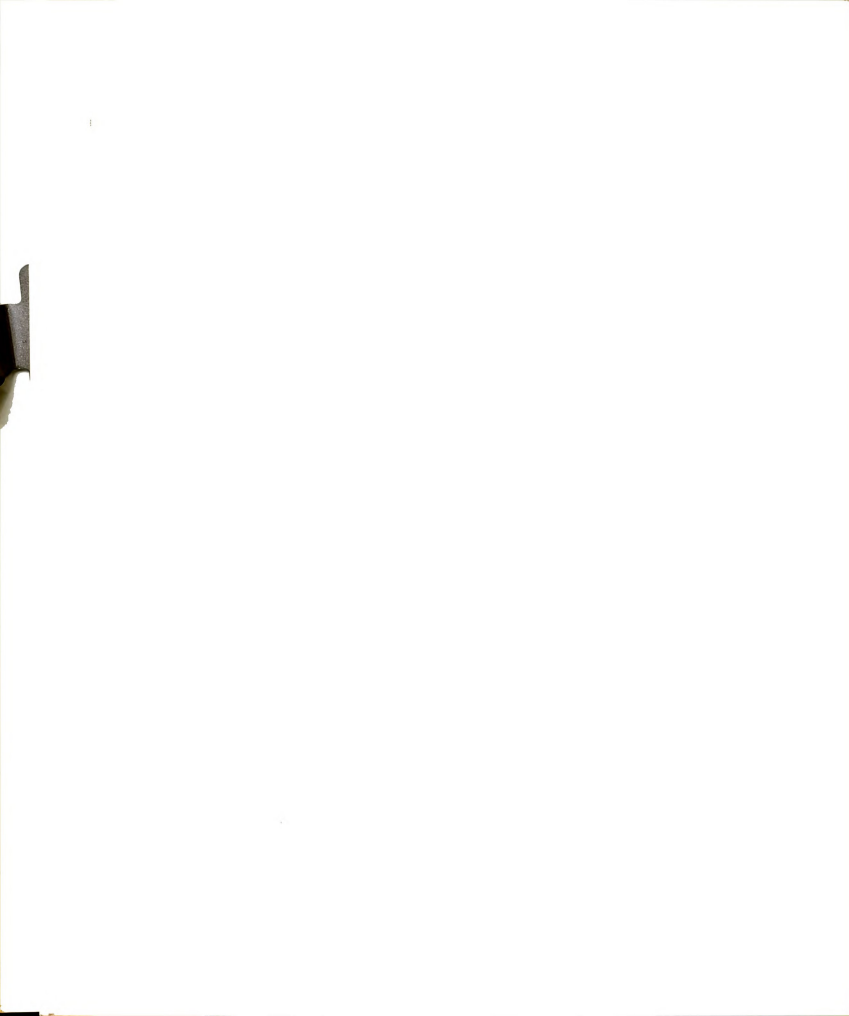
TABLE 3.1. United States Fertilizer Prices Relative to Prices Received by Farmers for Farm Products.

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 Center, An Occasional Paper, 1968.

During the latter period from 1950-61, fertilizer costs increased only 6 percent, in spite of a general rise in the index of farm costs, whereas farm real estate values increased 70 percent and farm wages increased 52 percent. A more recent and significant advance in fertilizer technology has been in the form of reduction in the capital and operating costs of nitrogenous fertilizers. In the United States, the capital cost of a basic ammonia plant

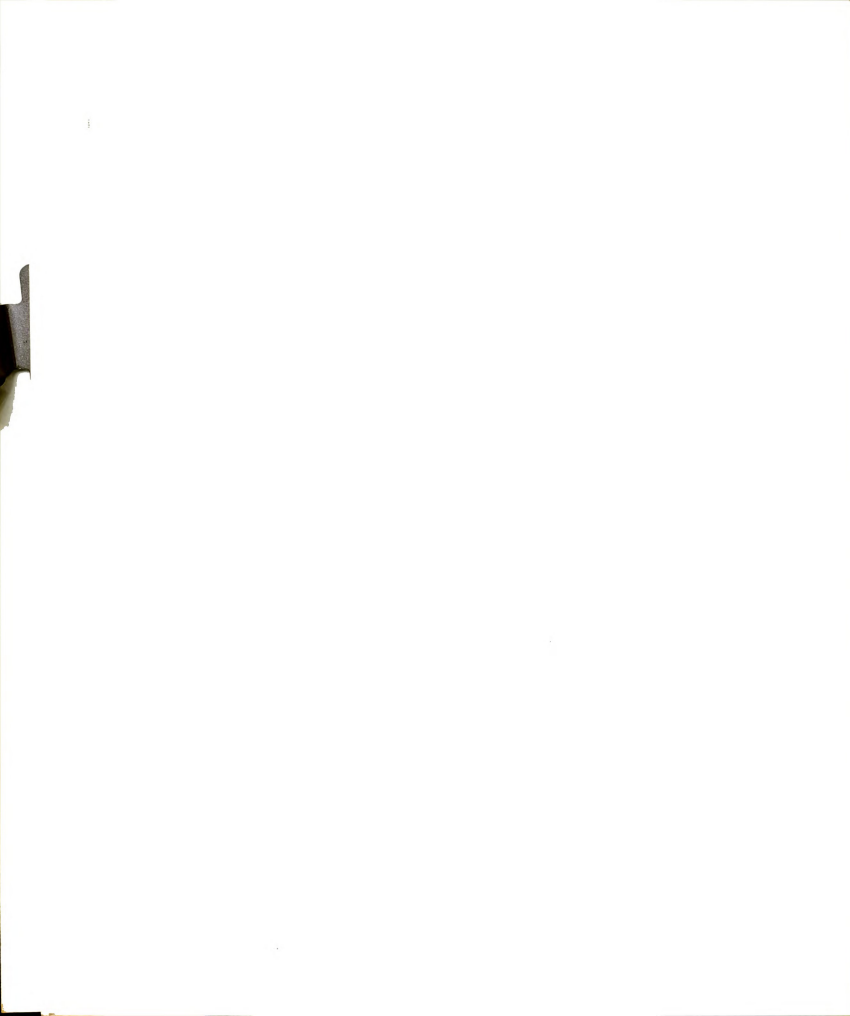
²⁶Development and Change in Traditional Agriculture: Focus on South Asia, Asian Studies Center, An Occasional Paper, 1968.



with the production capacity of 350,000 tons of ammonia per year has been reduced from \$45 to \$60 per ton in older plants and \$20 to \$30 per ton in plants making use of new technology.²⁷

A significant feature of the fertilizer industry is that it enjoys large economies of size and scale. A small-sized plant operating at full capacity may involve higher per unit cost of production than a large-sized plant operated at less than full capacity. On the other hand, the economies of scale obtained through the erection of a larger fertilizer plant could more than offset the diseconomies arising from low rate of capacity utilization. Since an industrial country has the most recent fertilizer technology, an accumulated reserve of technical know how, high intensity of fertilizer use, and compact marketing areas, it finds itself in a considerable advantage in enjoying the economies of scale and size that are associated with the production of fertilizers and conversion plants. Due to the fact that the cost of production in the fertilizer industry is inversely correlated with the size of the plant, economies of size that are available to smaller developing countries are, however, limited. The ratios of marketing and transportation costs in West

²⁷ OECD, Supply and Demand Prospects for Fertilizer in Developing Countries (Paris: OECD, 1968).



Pakistan are high because the marketing radius in which fertilizers are distributed tend to be extensive and the intensity of fertilizer use very low. Thus, the erection of a large fertilizer plant would mean that a larger marketing area must be served. It is quite possible that the savings arising from relatively lower investment costs in the erection of a larger plant may be offset by the transport cost disadvantage of smaller plants in closer proximity to their markets. As a new large fertilizer plant enjoys a high level of fixed costs, many of the apparent economies of size may disappear if these plants are not operated at near full capacity.

So far as the capital costs of varying sizes of fertilizer plants are concerned, a 300 ton per day plant is estimated to cost \$11.4 million with a production cost of \$31.67 per ton; as compared to a 1000 ton plant costing \$22.7 million, and producing ammonia at \$20.34 per ton. For 10 percent return on investment the 300 tons per day plant will have to sell fertilizer at \$67.50 per ton as compared to \$51.00 for a 1000 per ton per day plant.²⁸ New technological advances that have made possible economies of size in the fertilizer industry can be well assessed from Table 3.2.

²⁸Freeland and Adams, Fertilizer Statistics and Recent Developments.



TABLE 3.2. Effect of Economies of Size on the Production Cost of Urea.

Plant Capacity Tons Urea Per Day	Relative Index Plant Cost	Relative Index Cost Per Ton
200	100	100
500	67	78
1000	45	61

Source: Fertilizer Annual Review (Rome: FAO, 1966).

It has been estimated that with ammonia costing \$42 per ton, urea will cost \$441.39 for 1000 ton per day plant, as against the prevailing cost of \$878.36 per ton.²⁹

In the production of nitrogenous fertilizers, the economies of scale could be as much as \$9.5 per ton for Europe, \$7.7 for the United States, and \$9 to \$32 in case of India. The Indian case shows that the effect of economies of size is much more important between 250 and 500 tons per day than between 500 and 1000 tons per day. The following table shows the rate of capacity utilization for the larger plant at which the savings in operating costs due to economies of size are likely to be compensated by low capacity utilization. This rate could be as low as 56 percent in Europe for a 1000 ton per day ammonia plant as compared with a 500 ton per day plant. It could be 64 percent for a 500 ton per day plant in

²⁹Ibid.

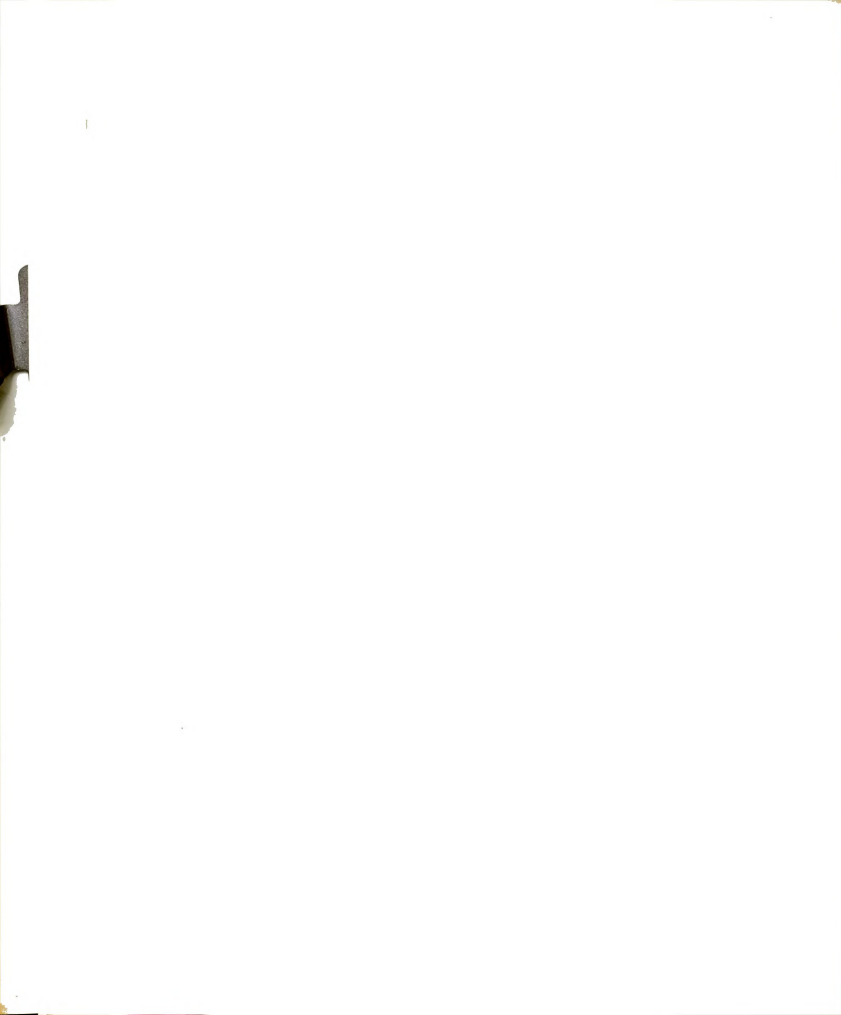


TABLE 3.3. Economies of Scale in Ammonia Production.

Description	Europe (Naphtha)	Gulf Coast (Natural Gas)	Brazil (Naphtha)	India (Naphtha)
1. Capacity per year in tons of ammonia	165,000	330,000	165,000	82,500
2. Total investment/ tons of installed capacity (tons)	119	93.5	104	83
3. Variable charges	25.2	21.9	14.9	12.4
4. Fixed costs (dollars)	28.7	22.5	25.4	20.02
5. Operating costs (dollars)	53.7	44.4	40.3	32.60
Rate of capacity utilization at which economies of scale are com- pensated by low capacity utili- zation	56%	58%	64%	62%
				46% over economies of scale and 57% medium plant

Source: OECD, Supply and Demand Prospects for Fertilizer in Developing Countries (Paris: OECD, 1968).



Brazil as compared with a 250 ton per day plant. On the contrary, in the Indian case, the rate of capacity utilization could fall from 80 percent to 57 percent when doubling the capacity from 500 ton per day to 1000 ton per day. The rate of capacity utilization could be as low as 46 percent when this alternative is compared with a 250 ton per day plant before the economies of scale are offset by the low rate of capacity utilization as illustrated in Table 3.3; some of the disadvantages that may arise from the erection of larger capacity fertilizer plants are delineated below:

1. A larger amount of local currency or hard currency is required at the beginning to take care of larger investments, entailing payments of interests of non-utilized capacity.
2. By the time the economies of size are fully realized, plant life might be drawing to a close and technical advances in industry might even minimize such related economies of size.
3. The higher the discount rate, the stronger will be the case against the building of productive capacity in anticipation of demand.



A fertilizer plant may be operating below capacity because of inadequate demand, non-availability of raw materials, lack of spare parts, inefficiency of management, and technical difficulties. Whether it will be profitable to increase the size of market by exporting fertilizer or increasing the rate of capacity utilization by overcoming the technical inefficiencies depends on the alternative costs involved. The extent to which production costs of fertilizers will be raised due to the operation of fertilizer plant at less than full capacity is indicated in the following table.

TABLE 3.4. Effect of Idle Capacity on the Production Cost of Urea.

Relative Utilization or Rated Capacity	Relative Production Cost Index of Urea
100	100
90	107
80	115
70	127
60	142
50	168
40	196

Source: Food and Agriculture Organization, A Preliminary Report of the Survey of Fertilizer Economy of the Asian and Far East Region (Rome: Food and Agriculture Organization, 1960).



Fertilizer production statistics³⁰ indicate that fertilizer plants operate at 85 percent of the rated capacity in West Pakistan which means that on the basis of criterion developed by the FAO concerning direct correlation between idle capacity and cost of production, the cost of fertilizers will be raised by about 10 percent as compared to a fertilizer plant operated at full capacity. On the basis of a straight-forward commercial criteria, it would frequently be more economical to import the finished products than to consider any form of local manufacture where the total market is limited, unless an increasing market potential proves capable of supporting a viable fertilizer producing plant. In addition, indigenous manufacture of fertilizers may also be justified where the location of fertilizer market tends to push up freight costs. Imported finished fertilizers will have to be transported to Pakistan not only by sea, but also up-country, if due allowance is made for handling and storage, freight costs can be considerable. The western region of Pakistan has large reserves of natural gas providing a cheaper source of raw material supply for the production of nitrogenous fertilizers. A large pool of available skilled and unskilled labor can be trained to take over the managerial and technical responsibilities.

³⁰Freeland and Adams, Fertilizer Statistics and Recent Developments.

The production of indigenous fertilizers in West Pakistan started with the establishment of a superphosphate factory at Lyallpur with the annual rated capacity of 3600 nutrient tons. Nitrogenous fertilizers came on stream in 1958 with the erection of a fertilizer plant at Daudkhel for the production of ammonium sulphate with the annual rated capacity of 10,500 nutrient tons. In response to the rapidly rising demand for nitrogenous fertilizers, another urea and calcium ammonium nitrate producing plant was set up at Multan with an annual rated capacity of 56,833 nutrient tons. It was based on indigenous raw material supply of natural gas. Emphasis on the production of nitrogen and phosphates was laid, because almost all agricultural regions of West Pakistan responded to varying doses of nitrogen and phosphorous and in the areas where soil erosion was active or which were under paddy would respond to potassium as well. Phosphate deficiency does not only exist in the alluvial soils of Indus Valley, but is also reflected in a pronounced shortage in the soils of Peshawar Valley. Generally the pattern of crop production, type of irrigation system, and nutrient requirement of the soils of given agricultural regions determine the level of intensity and points of demand for various combinations of given types of fertilizers. Whether fertilizer plants should be located near the areas of demand or sources of raw material supply depends on a number of theoretical



considerations. In general, the location of an industry is often ideally determined by the ratio between localized raw materials and weight of the product. Since fertilizers have a relatively higher material index (though less than unity) and are weight-losing in nature, fertilizer producers will tend to concentrate near raw material sources.

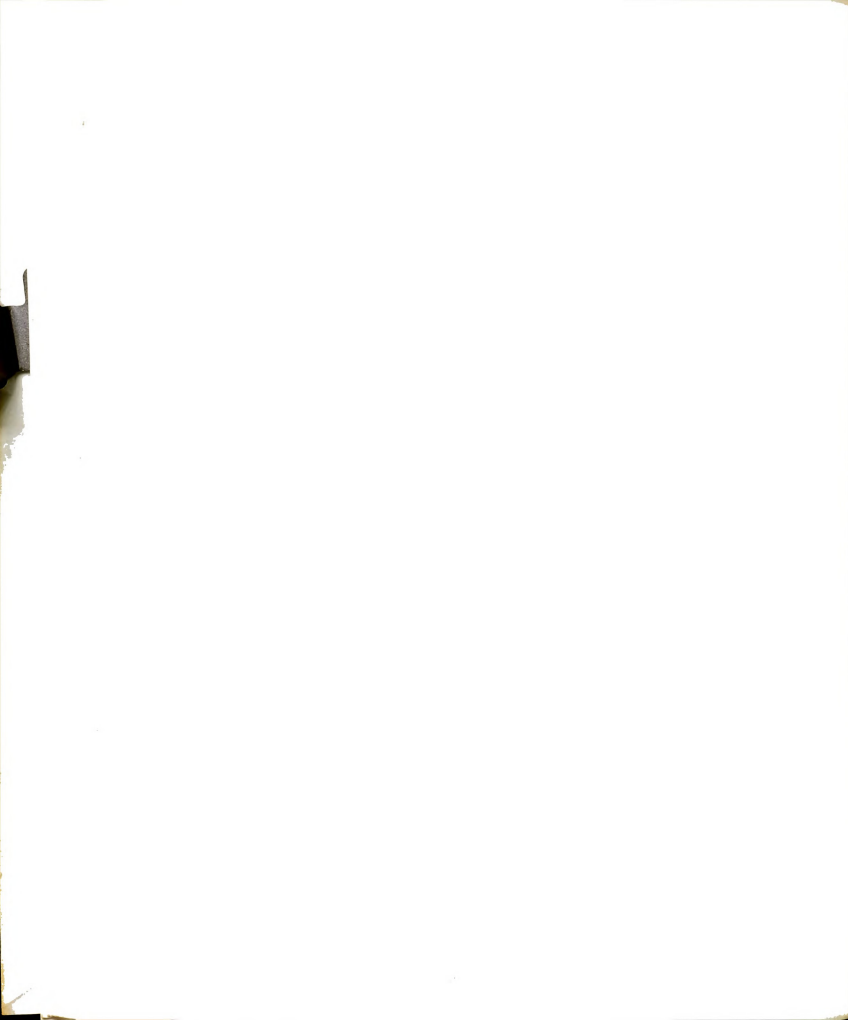
On the other hand, production of nitrogenous fertilizers based on natural gas gets some locational flexibility, if pipelines permit closer proximity to market areas; furthermore, they are not large weight-losing operations. In either case, the labor coefficient is relatively low and the influence of high or low labor costs from other areas is not great. The existence of the natural gas pipeline in a semi-circle throughout West Pakistan permits the location of urea producing plants near the areas of demand. The map of West Pakistan (Figure 3.3) identifying the locations of existing and proposed fertilizer plants indicates that nitrogen and phosphate plants tend to be located at different places, despite the high level of complementarity between the two nutrients, whereas two nitrogenous fertilizer plants are located at the same place. Under this situation, an attempt to provide mixed fertilizers to farmers will raise the costs of mixing to the extent of the cost of transportation for fertilizer and commuting between Multan and Lyallpur or Daudkhel and Lyallpur depending on the location of fertilizer mixing plants. Although





Source: John M. Hill, West Pakistan Fertilizer Handling and Marketing Survey (Pakistan: USAID, 1968).

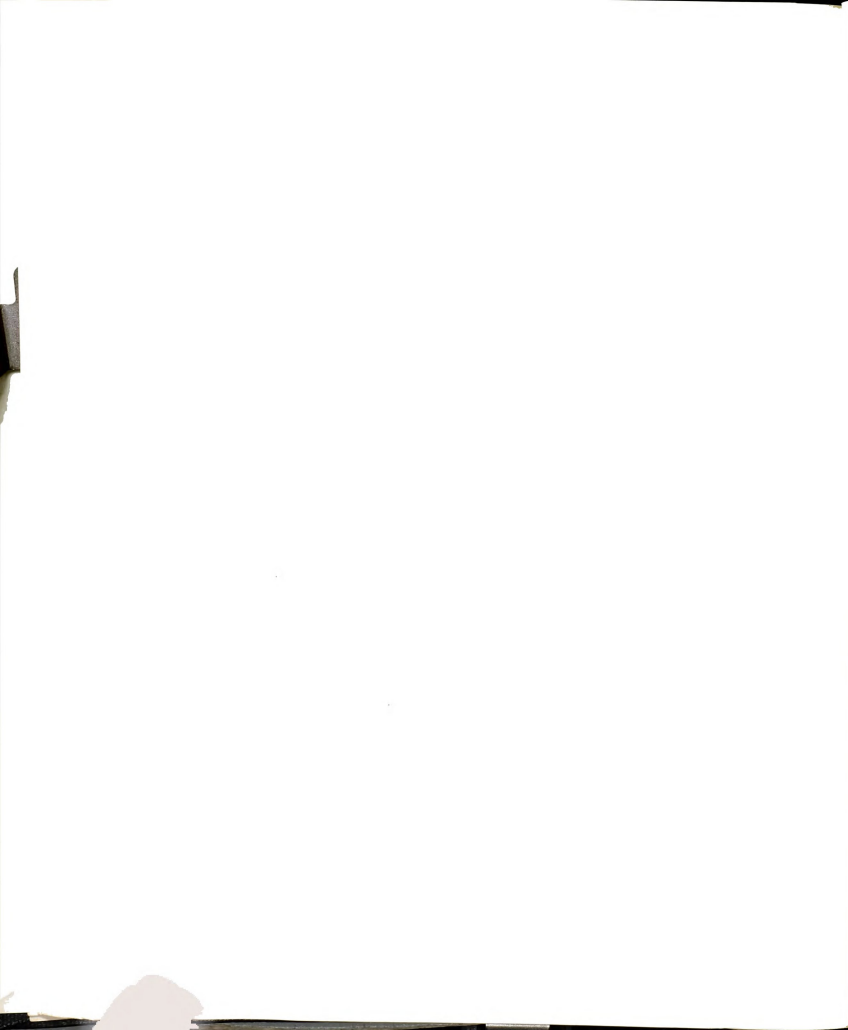
Figure 3.3. The Existing and Proposed Sites of Fertilizer Plants in West Pakistan.



no fertilizer mixing facilities exist at present, it is obvious that unilateral use of one single nutrient, e.g., a heavy dose of nitrogen, or use of phosphates without nitrogen, is likely to give lower yield response. The present roughshod method of mixing fertilizers is unscientific, inadequate, involves waste, and increases the cost of nutrient assimilation for the farmers. Furthermore, determination of nutrient requirement is based on no laboratory method of soil testing and involves no basic principle of mixing fertilizers.

The economic justification of having two urea plants at the same place with the production capacity of 183,600 and 153,000 nutrient tons each can be disputed. Although the two fertilizer plants at Sheikhpura are under the ownership of two different private entrepreneurs, a single large plant with an annual rated capacity of 330,000 nutrient tons could be set up with considerable benefits of economies, size, and scale. A study conducted by OECD concludes that a nitrogenous fertilizer plant with the installed production capacity of 330,000 nutrient tons when operated at above 57 percent capacity would enjoy economies of scale and thus lower per unit costs of production.³¹ It is quite possible that the location of two fertilizer plants at the same place may yield the

³¹OECD, Supply and Demand Prospects for Fertilizer in Developing Countries.



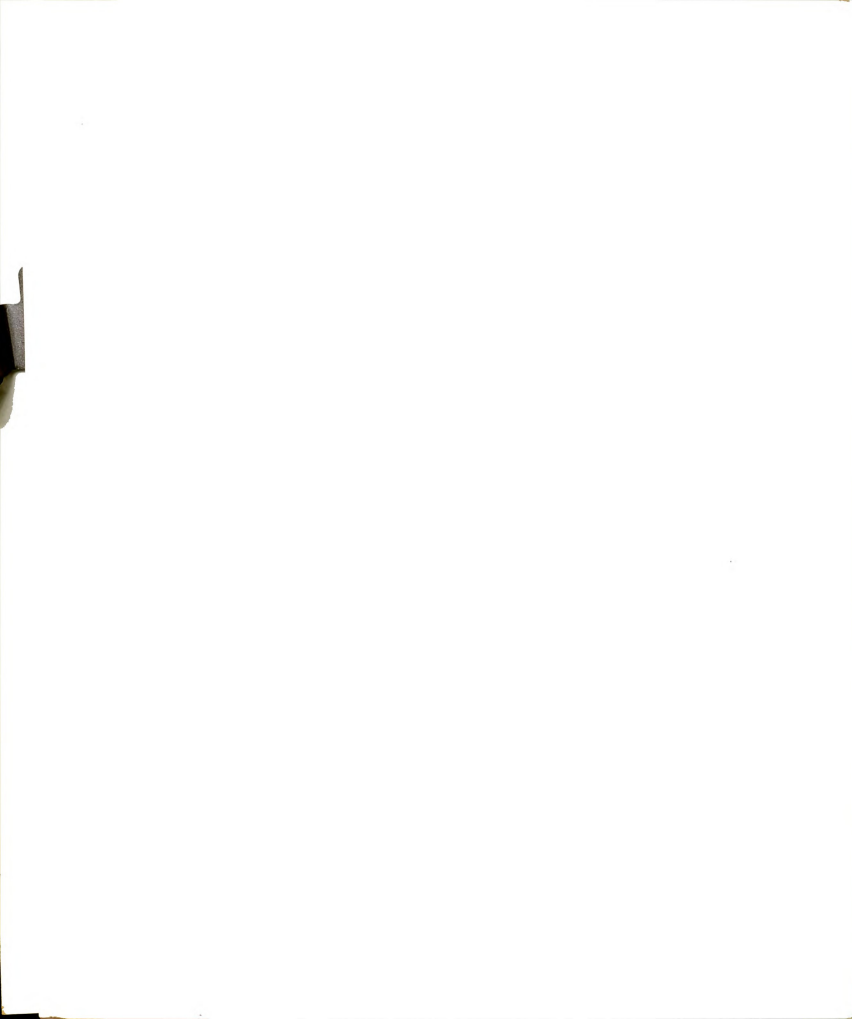
benefit of external economies arising from the provision of basic infra-structural facilities; but the economies of size and scale tend to outweigh the external economies if any, and which are only minimal. The demand for fertilizer in West Pakistan is growing at an annual average rate of 30 percent and according to one study from an average consumption of 5 pounds of ammonium sulfate per cultivated acre of land, West Pakistan has the potentiality to profitably make use of 300 pounds of fertilizer per acre.³² The future expansion of these fertilizer plants can, therefore, make use of the available external economies. Alternatively, one of the two urea plants at Sheikhpura could be shifted to an approximate distance of 60 miles at Lyallpur to supplement an existing super-phosphate facility. It could also raise the future possibilities of producing mixed fertilizers. Similarly, two urea plants are proposed to be set up at Daharki which could be easily substituted by a single urea plant in order to take advantage of the economies of size and scale and to reduce the per unit cost of production. Alternatively, one of the urea plants could be shifted either to Hyderabad or Karachi, whereas Hyderabad division being an area with a relatively high density of cultivated acreage presents sufficient local fertilizer demand.

³²Harza Engineering Company International: An Appraisal of Resources and Potential for Development, 1963-75.



Change of location for the urea plant to Hyderabad will, therefore, reduce the marketing radius and costs of fertilizer shipment to the farm areas lying in this region. Similarly, the shifting of this urea plant to Karachi could increase the possibilities of having mixed fertilizers for the farmers at a relatively lower cost than the costs incurred by having nitrogen and phosphate producing plants at a considerable distance. In addition, the urea and triple superphosphate plants located at Karachi can service the coastal area and other accessible farm areas with mixed fertilizers at a much lower cost of local fertilizer delivery. Thus the choice of location site between Hyderabad and Karachi would depend upon whichever is the best.

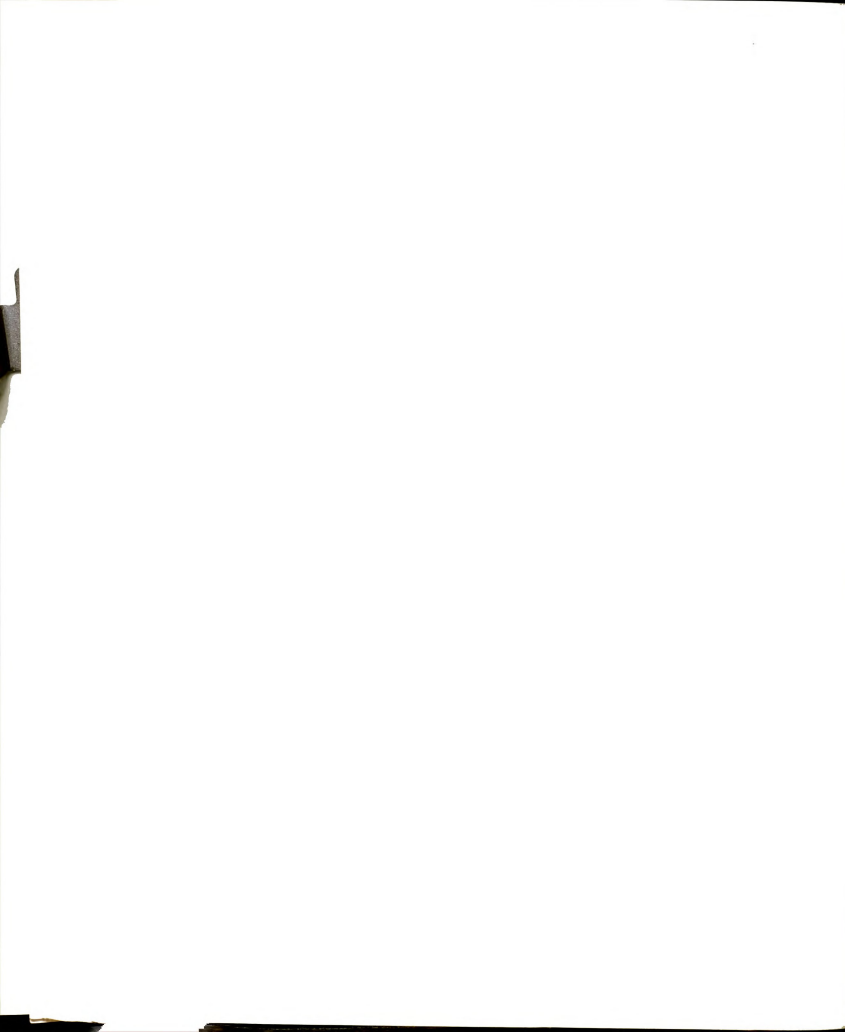
From the structural point of view, the fertilizer industry in West Pakistan is in the early stages of development. The size of the indigenous fertilizer industry is, however, limited due to the low level of farm income, non-availability of complementary inputs, and lack of credit availability. At present, there are only three plants under the ownership of a semi-autonomous body, the West Pakistan Industrial Development Corporation. The plants are operated on a commercial scale like a profit-motivated private enterprise with management controlled by the corporation. The organization of WPIDC was instituted by the government in order to complement the private enterprise in the promotion of industrial growth and to make



investments in those ventures in which private sector tends to be very shy. Thus WPIDC as a government patronized body came to enjoy almost complete monopoly in the production of fertilizers with the exception of a few private producers who are in the process of starting their production operations. This change, however, augurs well for the fertilizer industry as well as farmers. Our knowledge of economic theory indicates that it generates a sub-optimal level of economic welfare for the farmers due to the excess of the loss of farm consumer's surplus over the gain to the monopolist. Since monopoly prices are almost invariably higher than competitive prices, a redistribution of income from farmers to the monopolists tends to occur.

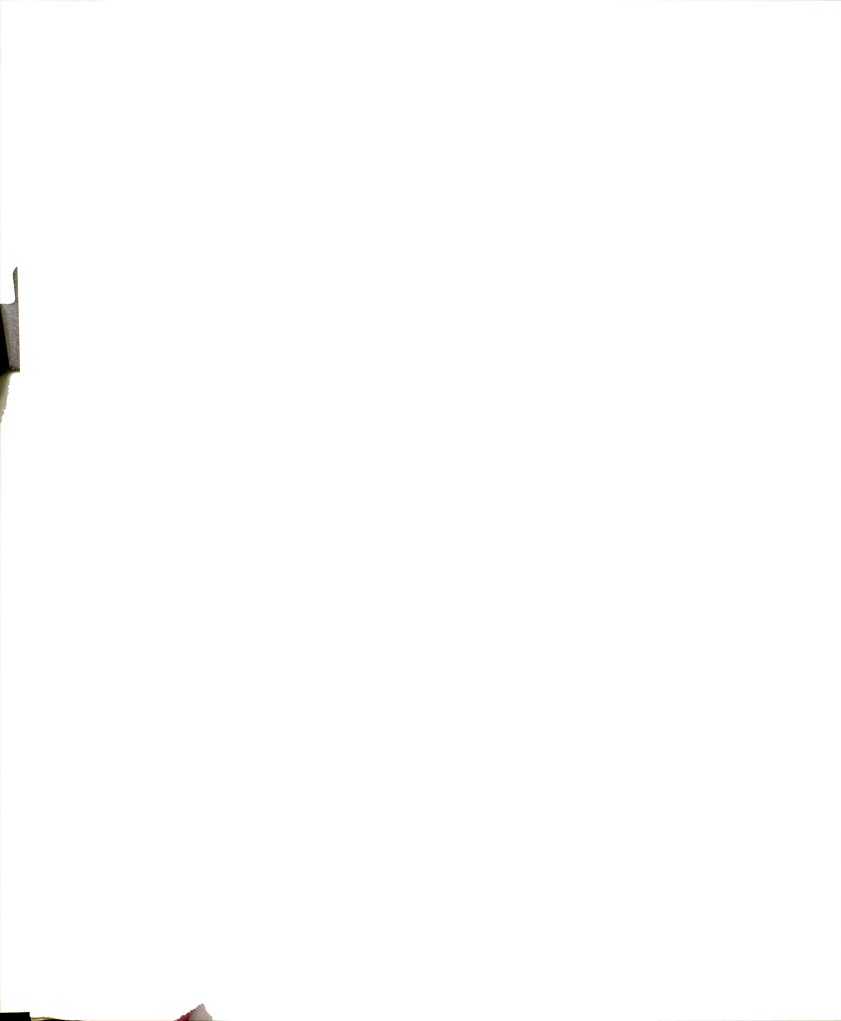
At present, no product differentiation in terms of brand name, trade mark, or a particular mix of fertilizers is being practiced, except for the fact that all three fertilizer plants produce various types of fertilizers. The factory at Multan produces calcium ammonium nitrate with 26 percent nutrient content of nitrogen and urea with 46 percent and the one at Daudkhel produces ammonium sulfate with only 21 percent nitrogen content. Apparently, a bag of calcium ammonium nitrate will be priced higher than ammonium sulfate and a bag of urea will be priced even higher.

The seller concentration ratio is expected to decline with the expansion of fertilizer market, rise in



farm income, greater fertilizer consciousness of the farmers, and as new firms come on the horizon and private enterprise is encouraged to invest. As the number of sellers increases competition is likely to become more intense, and prices are expected to be lower. Collusion is likely to become progressively more difficult and economies of size and scale would gain more importance. At present, barriers to entry for the private enterprise are high because the capital costs and its foreign exchange component are high. A limited fertilizer market offers the challenge of high selling costs and riskiness of business for a new private entrant. The cooperation of government and intensive efforts by the department of agricultural extension can do the initial spade work for the sale of fertilizer by private firms and thereby reduce the per unit selling costs of fertilizers. Figure 3.4 illustrates the position of a new firm vis-a-vis an old fertilizer firm.

Since the fertilizer industry is subject to a rapid technological change, the new firm is likely to have the benefit of new cost-reducing technology involving substantial economies of size and scale. It is quite possible that the average unit costs of production for the new private firms may be much lower than old established firms with obsolete technology. This is illustrated in Figure 3.5.



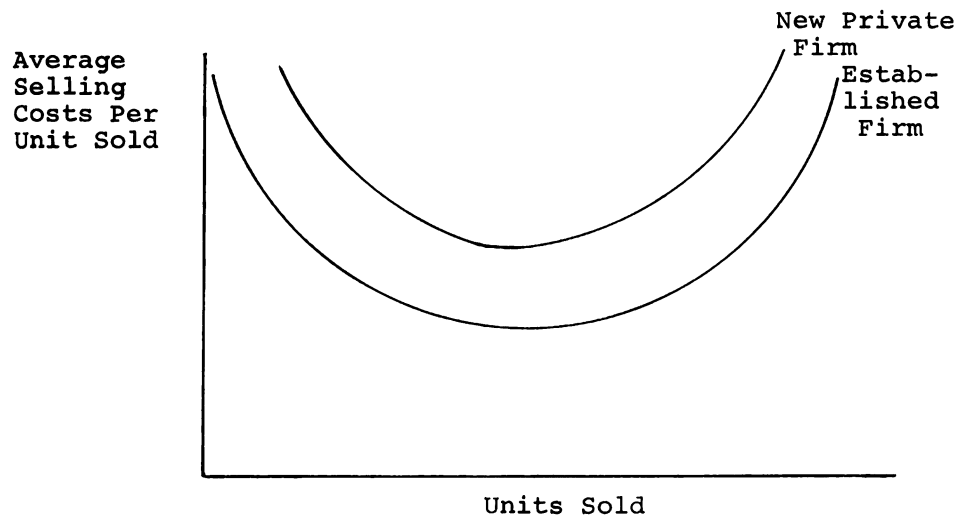


Figure 3.4. High Barriers to Entry for a New Private Entrant.

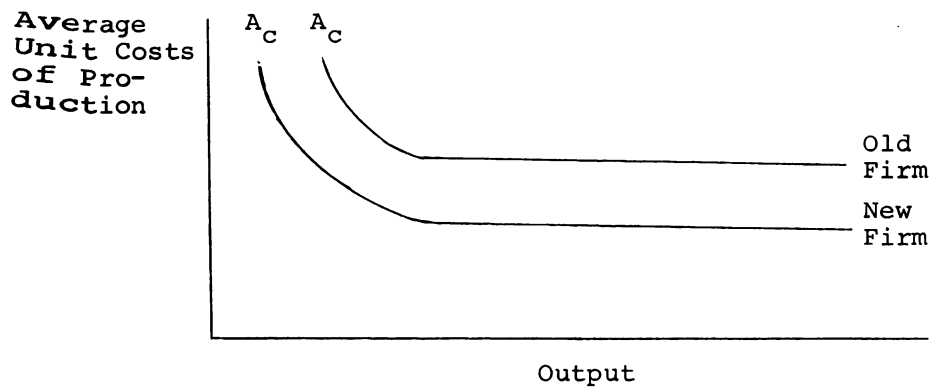
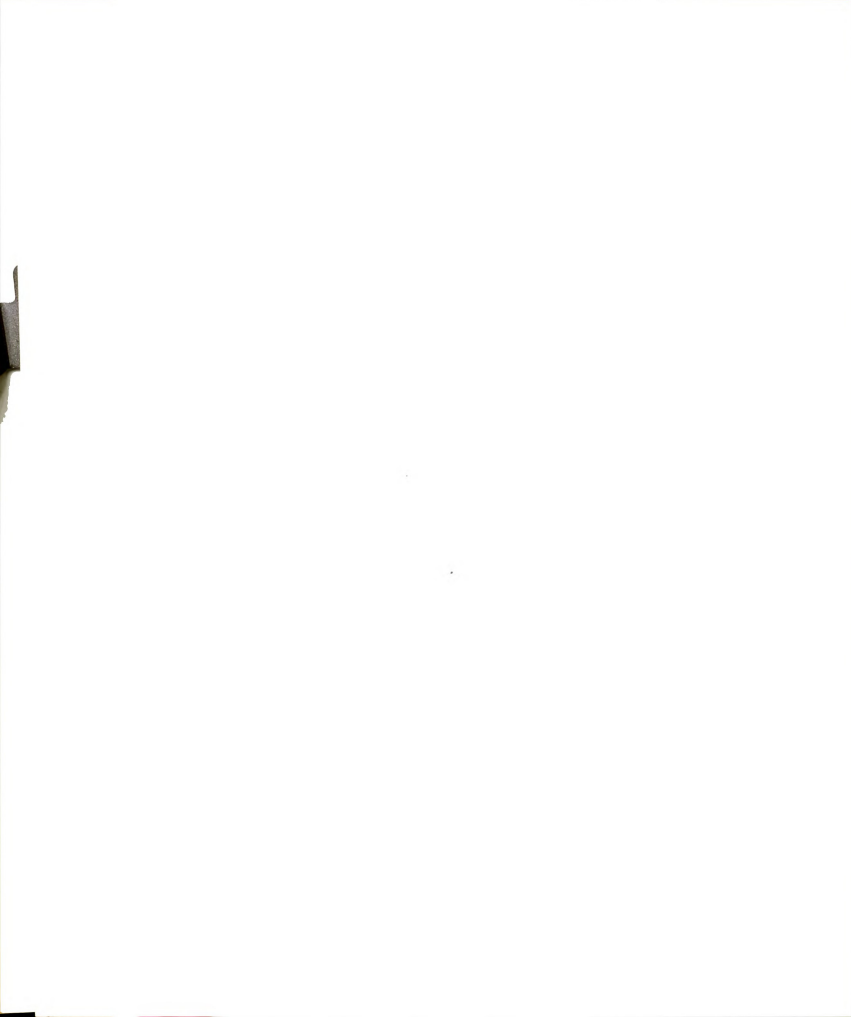


Figure 3.5. Economies of Size and Scale Effect for a New Private Firm.

Such a situation is likely to arise with the new fertilizer plants proposed to be set up during the next four or five years. Almost all of these plants are likely to have a larger capacity than the old plants which means a lower per unit cost of production but the huge selling effort required to dispose of fertilizers is likely to increase their variable costs. The proposal to expand the production capacity of existing plants is well taken. Transportation costs per unit of fertilizer sold are likely to increase, because a greater plant capacity can serve a larger marketing radius. The market structure of the fertilizer industry is likely to undergo considerable change, in view of the rapid rise in the demand for fertilizer and growing interest of private enterprise in the fertilizer industry. One of the new developments in the production structure of the fertilizer industry is the location of two almost identical fertilizer plants both at Sheikhpura and Daharki under the ownership of different entrepreneurs. It can lead to the possibility of tacit agreements, price collusion, joint profit maximization, or market sharing. Moreover, the other fertilizer plants which are located at a considerable distance may not be able to competitively encroach upon the isolated and well protected markets of the two firms. Because the ratio of transportation and distribution costs to the price of fertilizer tends to be high, the geographical differential

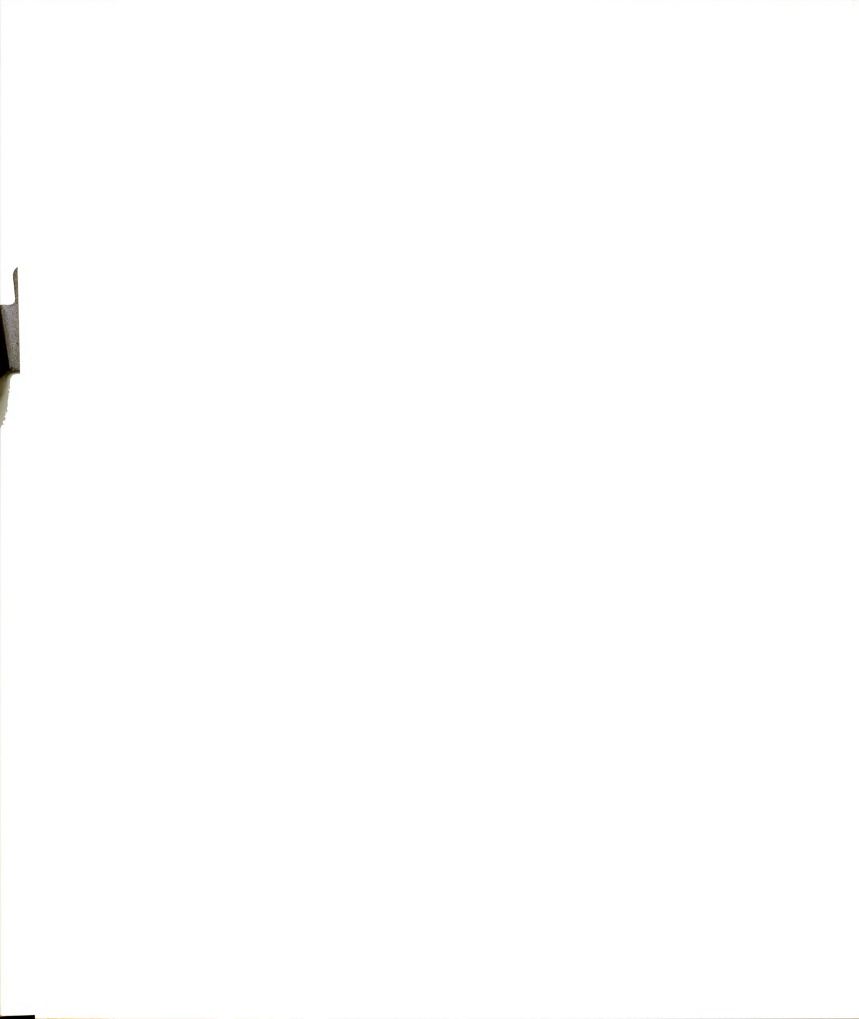


may also be prohibitive for effective competition. Alternative location of these plants could create the possibility of improving the performance of the fertilizer industry.

Supply of Imported Fertilizers

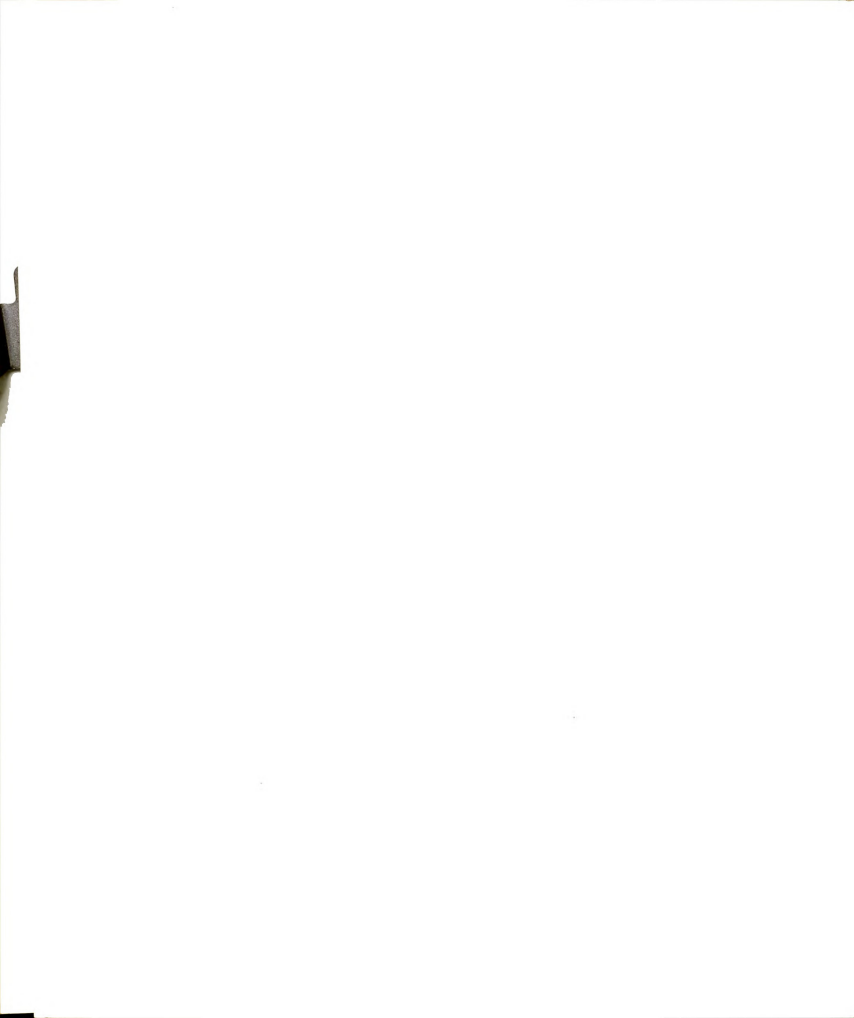
Fertilizer imports constitute an important component of the overall supply of fertilizers in West Pakistan. Variations in this component are likely to create fluctuations in the market supply of fertilizers. From the temporal point of view inaccurate timing of fertilizer imports is likely to affect the overall supply of fertilizers at a particular point of time in a given crop-year. The difficulties in channelling the flow of fertilizers to the farmers tend to create spatial variations in the supply of fertilizers. Thus, in the case of free market operation, the prices of fertilizers are likely to vary at a particular time and place, unless appropriate measures are taken to stabilize them.

A government decision to develop indigenous fertilizer production capacity does not imply that no fertilizer will be imported. Fertilizer may be imported because a limited fertilizer market does not permit the development of indigenous fertilizer production or the per unit cost of fertilizer produced domestically may be too high relative to the price of imported fertilizers. In India, for example, the cost of producing fertilizers is 5 percent

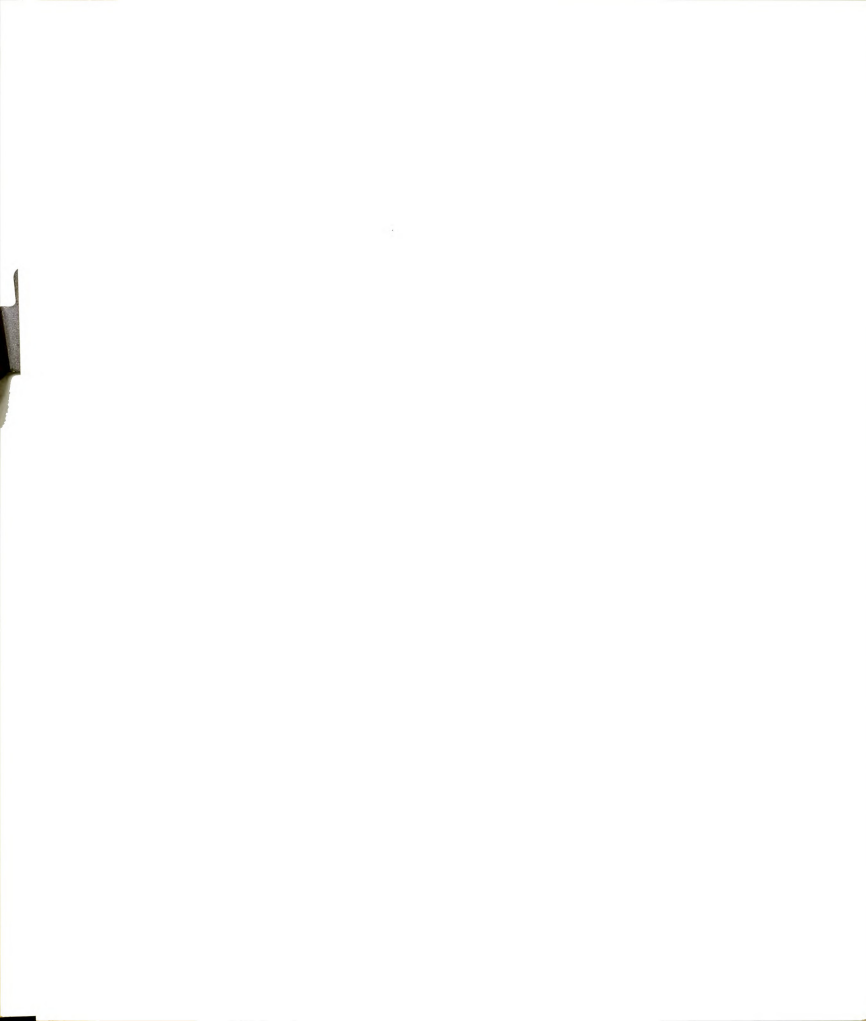


higher than in the United States.³³ In addition, fertilizer may be imported initially in order to achieve market penetration and stimulation of demand. A case in point is the import of fertilizers in 1952-53 for demonstrating the benefits of fertilizer use to farmers. Ever since, fertilizer has been almost continuously imported in West Pakistan to supplement the indigenous supply of fertilizers so that favorable effects of fertilizer subsidy could be effectively communicated to farmers by keeping down the prices of fertilizer. Foreign exchange being a scarce commodity, it 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 required foreign exchange allocations could be sought and tenders given. The primary responsibility for fertilizer imports rests with the Agricultural Development Corporation which arranges for the shipment of fertilizers from exporting countries, the major exporter being the United States. Annual fertilizer import requirements are based on the net difference between predicted demand and domestic fertilizer production forecast. Agricultural Development Corporation works in close cooperation with the Planning Department which, in turn, consults the Ministry of Finance and Economic Affairs Division to

³³Max F. Milliken and David Hapgood, No Easy Harvest: The Dilemma of Agriculture in Underdeveloped Countries (Boston: Little, Brown and Co., 1967).

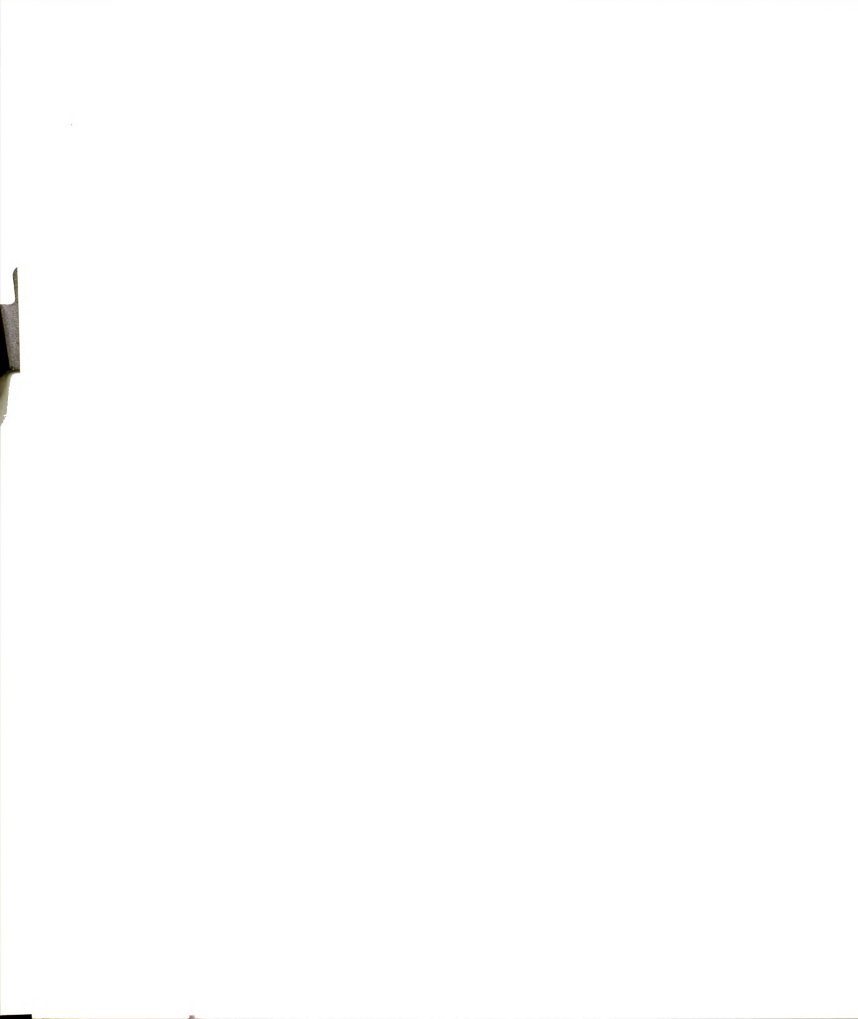


obtain foreign exchange allocations and consults West Pakistan Industrial Development Corporation to determine the indigenous fertilizer availability. Whether or not fertilizer imports will arrive in time depends upon how early the orders were placed and how well the internal fertilizer distribution system can handle the large supply of fertilizers by channelling it into given outlets. In spite of a generally rising trend, the demand for fertilizers from year to year does not show a constant increase, but irregular fluctuations that may be due to a number of uncontrolled variables. Since production capacity of indigenous fertilizers during a particular crop-year is technologically limited, the irregular changes in the consumption of fertilizers will have to be offset by changing the fertilizer imports or evened out by a fertilizer stabilization stock to ensure a smooth flow of fertilizers to the farmer so as to prevent recurrence of blackmarket practices. The stock requirements are normally determined by a stock turnover ratio of one-third. Much, however, depends on the number of different types of fertilizers, quantities stored, and the number of distribution points. Since in West Pakistan the number of different kinds of fertilizers is limited, and the number of distribution points is large, a stock turnover ratio of 15-20 percent seems advisable. In cases where aid has to be negotiated and tenders to be invited, fertilizer import requirements



must be determined much ahead of time. The work must be taken in hand in the month of January, if fertilizer is to be shipped from the port of departure in mid-April, unloaded at Karachi port in July, allowing a period of one to one-half month for the internal transport and distribution system to perform its functions so that fertilizer reaches the farmer in mid-August or September. In other words, arrangements for the import of fertilizers which are to be consumed by the farmer in the month of September, 1970 must have begun in December, 1969.

Whether or not foreign exchange saving can be effected through a deliberate choice of exporting firm and mode of shipment depends on the type of fertilizers and whether fertilizers are imported in bulk or bagged form. It has been estimated that, at present, for United States AID financed fertilizers, a difference of about seven or eight dollars per ton exists in the c.i.f. cost of bulk versus bagged fertilizers. This difference may exchange occasionally depending on shipping costs from plant to port in the exporting country, its bagging costs, extending charges, and ocean freight rates. The products that lend themselves to bulk shipping and handling are phosphate products, NPK compound fertilizer, calcium ammonium nitrate, muriate of potash, and ammonium sulfate. With fertilizer imports amounting to 200,000 to 220,000 tons of fertilizers in 1969 which could lend itself to bulk



handling West Pakistan could effect a foreign exchange saving of \$1 million to \$1.5 million by buying bulk fertilizer.³⁴ A comparison of the prices of bulk and bagged fertilizers could be made by Table 3.5.

In order to avoid fertilizer losses arising from poor techniques of handling bulk fertilizer, leadage from fertilizer bags, and their non-standard weight as well as a high probability of fertilizer caking, the use of portable automatic bagging machines would be advisable. The cost of bagging equipment and its accessories with per month bagging capacity of 40,000 tons is estimated to be \$225,000. At present West Pakistan meets 60 percent of its demand for fertilizer through imports, whereas 95 percent of the imported fertilizer will have to be shipped by railcars with an average turn-around period per car of twenty days. Fertilizer and foodgrains get first priority both on dock space and railroad cars. Yet the shortage of railroad cars makes it difficult to discharge more than 1500 tons of fertilizer per day. Whereas projected fertilizer requirements for the year 1969-70 show that about 854 thousand product tons of fertilizer will have to be imported. It implies that the handling capacity of already over-loaded Karachi port will have to be expanded. Assuming a work year of 350 days, an average load

³⁴ John M. Hill, West Pakistan Fertilizer Handling and Marketing Survey (Pakistan: U.S. Agency for International Development, 1968).

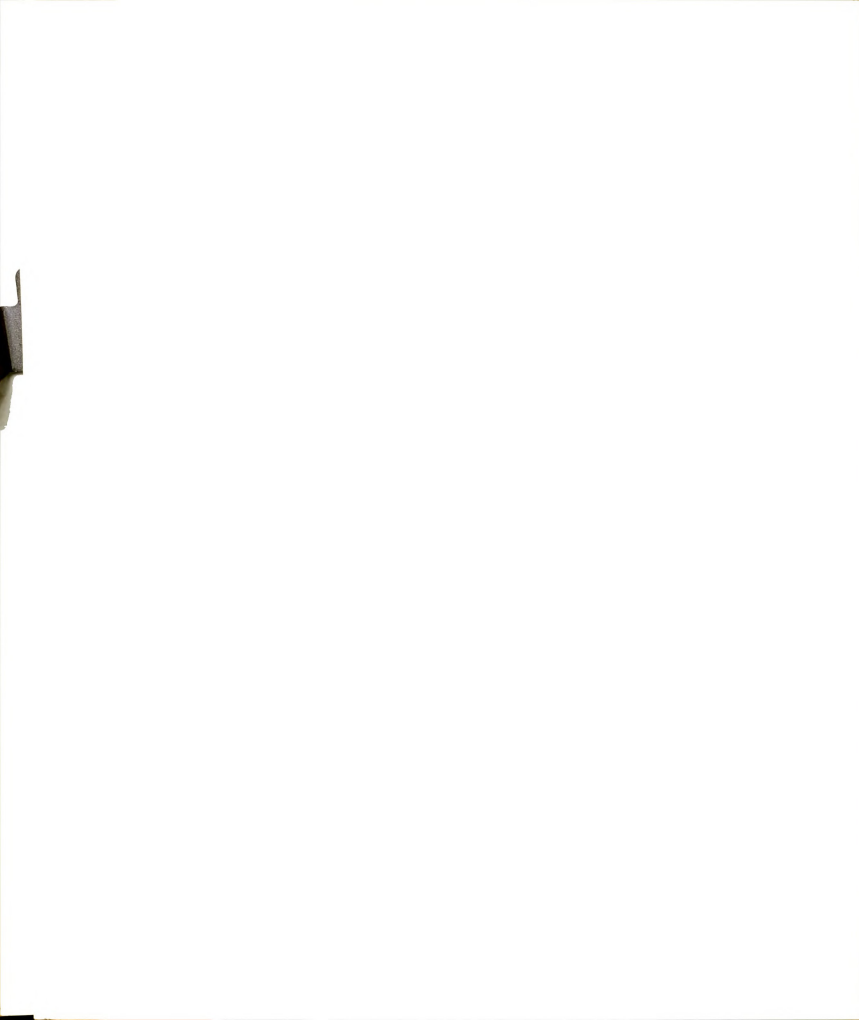
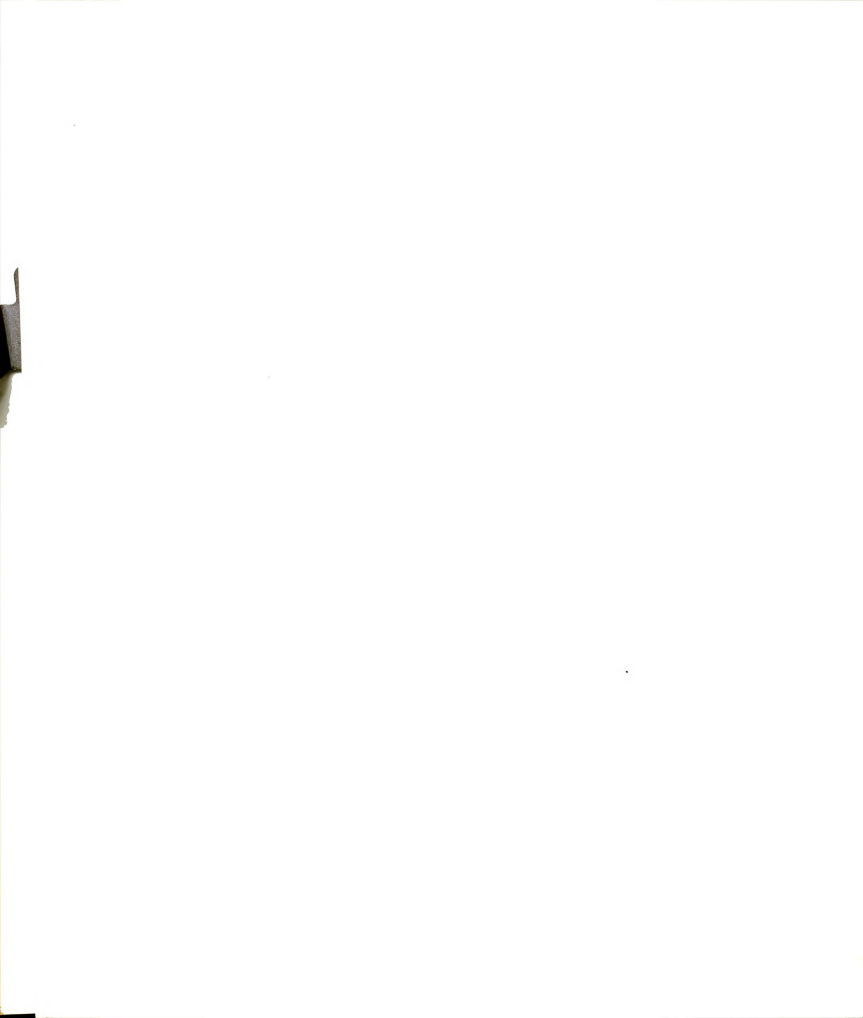


TABLE 3.5. The Costs of Bulk Versus Bagged Fertilizer Shipments Per Metric Ton.

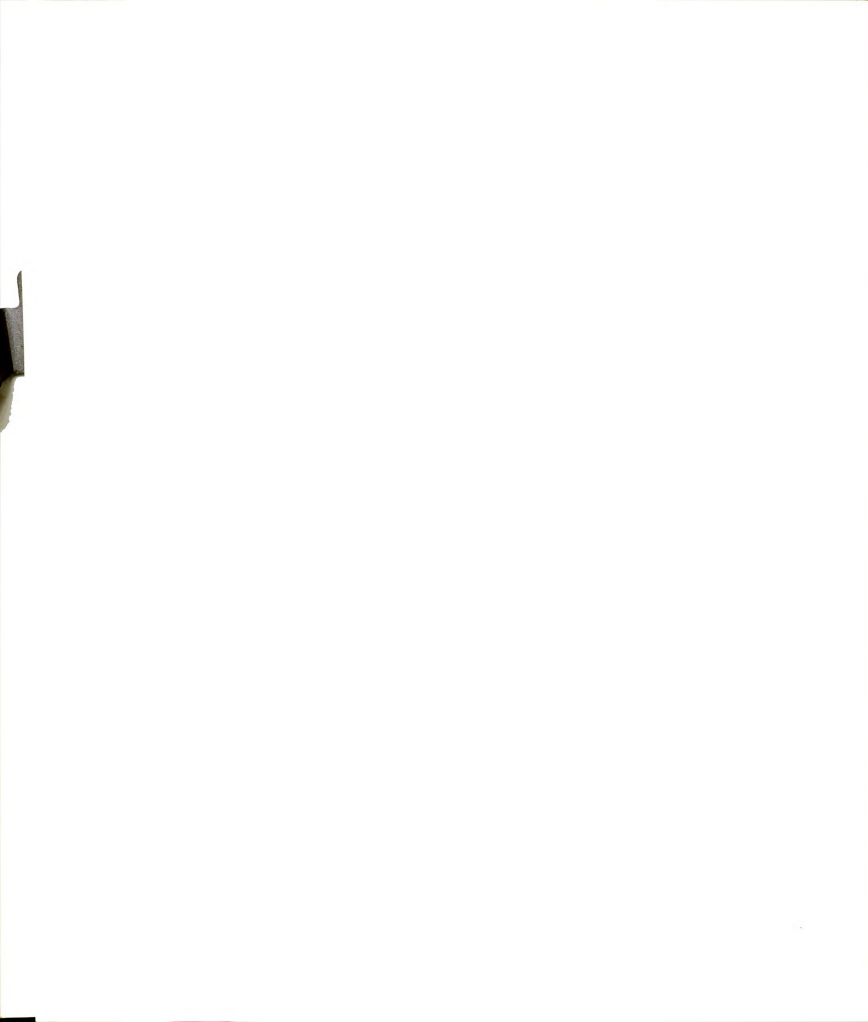
Bulk Shipments				
Product	US Cost Bulk F.O.B. Vessel	US Flag Charter for Bulk Cargo	Total Dollar c.i.f. Cost Karachi	Rupee Cost of Discharge Bag and Bagging
1. Triple superphosphate 46 percent P_2O_5	\$42.00	\$39.35	\$81.35	Rs 35.00
2. Diammonium phosphate 16-48-0	62.00	39.35	101.35	Rs 35.00
3. Sulfate of potash 50 percent K_2O	25.75	39.35	65.10	Rs 35.00
Bagged Shipments				
Product	US Cost Bagged F.O.B. Vessel	US Flag Charter for Bulk Cargo	Total Dollar c.i.f. Cost Karachi	Rupee Cost of Discharge
1. Triple superphosphate 46 percent P_2O_5	\$49.00	\$40.43	\$89.43	Rs 5.00
2. Diammonium phosphate 16-48-0	68.50	40.43	108.93	5.00
3. Sulfate of potash 50 percent K_2O	38.00	40.43	78.43	5.00

^aShipments from U.S. East Coast to Karachi.^bShipments from U.S. Gulf Coast to Karachi is \$43.76 per ton bagged and \$42.75 per ton bulk.



of 2,440 tons of imported fertilizer will have to be shipped per day which is much more than the railway's handling capacity. In addition, two bagging machines will be required to handle the bulk of fertilizer for a full working year. Since the arrival of fertilizer loaded ships is not scheduled so as to keep the dock busy all year round, ships may arrive three at a time and none in a period of three months. Demand for limited dock space and dock workers for fertilizer unloading, bagging, and storage will be irregular. Even if the bids for fertilizer delivery are assumed to be given in time and arrival of ships well scheduled, fertilizer unloading, bagging, and storage work can remain at the most for eight months in a year. Any excess in the working period can be assumed to result in fertilizer losses through caking, spoilage, delayed delivery of fertilizer to farmers, and non-availability of limited dock space for alternative uses.

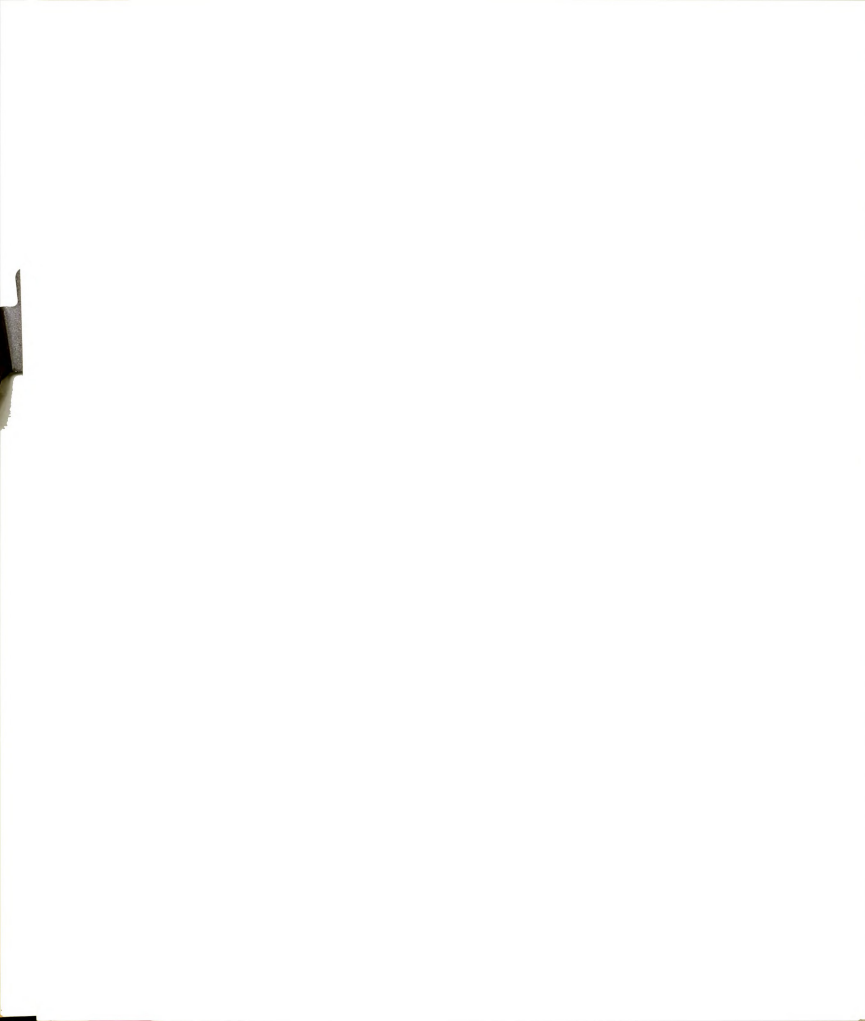
In view of the limited railway capacity to channel the flow of fertilizer to various distribution centers, a large warehouse at Karachi to regulate the supply of fertilizers seems feasible. Its capacity can be determined by the ratio of stock turnover to annual fertilizer import requirements. The rate of turnover at this warehouse can be increased by increasing the railway's fertilizer handling capacity and raising the efficiency of fertilizer bagging on the dock by adding more units of

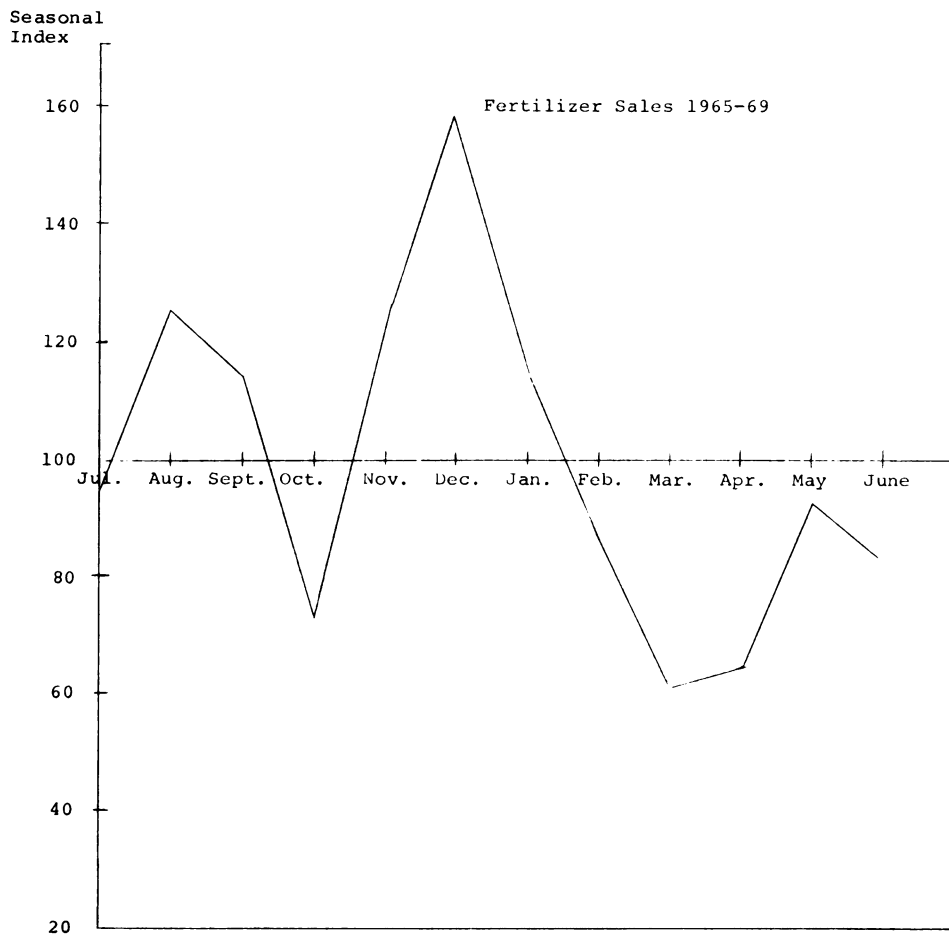


automatic bagging machines. Since the demand for fertilizer by farmers tends to be seasonal, imported fertilizers can be used to even out the peak demand. It implies that the demand for railway handling capacity will be seasonal and may reach its peak during the period that just precedes the peak of demand for fertilizer. Thus, it is possible that daily capacity of 1500 tons may not be used during certain periods but a capacity of 10,000 tons may be needed during other periods.

Demand for Fertilizer

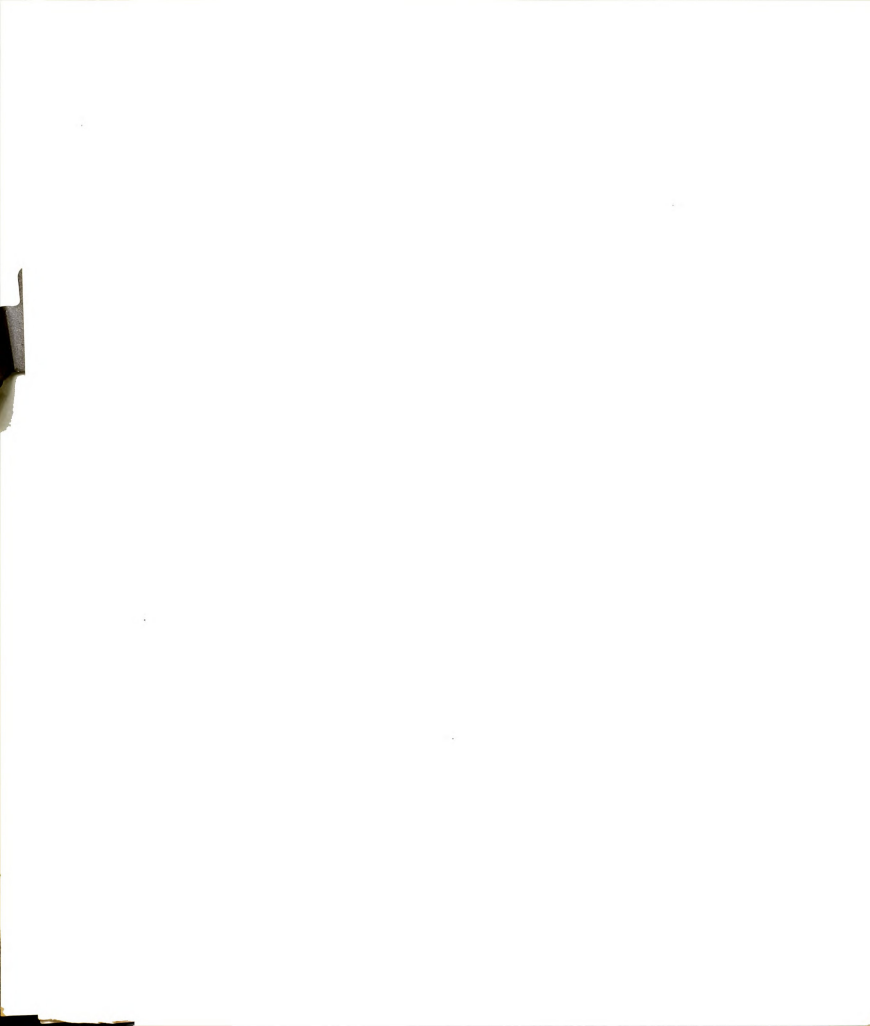
The demand for fertilizer in West Pakistan is highly seasonal and tends to vary with the sowing times of two major crop seasons, i.e., Rabi and Kharif. An index of seasonal variation (see Figure 3.6) for fertilizer sales constructed by twelve-month moving average of monthwise sales data in West Pakistan, indicates that the demand for fertilizer is marked by peaks and troughs. Fertilizer demand reaches its peak in December, when the major staple food crop of wheat is grown during the Rabi season. Fertilizer sales are second highest during the month of August when fertilizer is used for top-dressing cash crops like sugarcane, cotton, fruits, and vegetables. On the other hand, it reaches its low during the months of October and March which do not coincide with the time of fertilizer application. Temporal variations in the demand for fertilizer tend to interact with the spatial





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

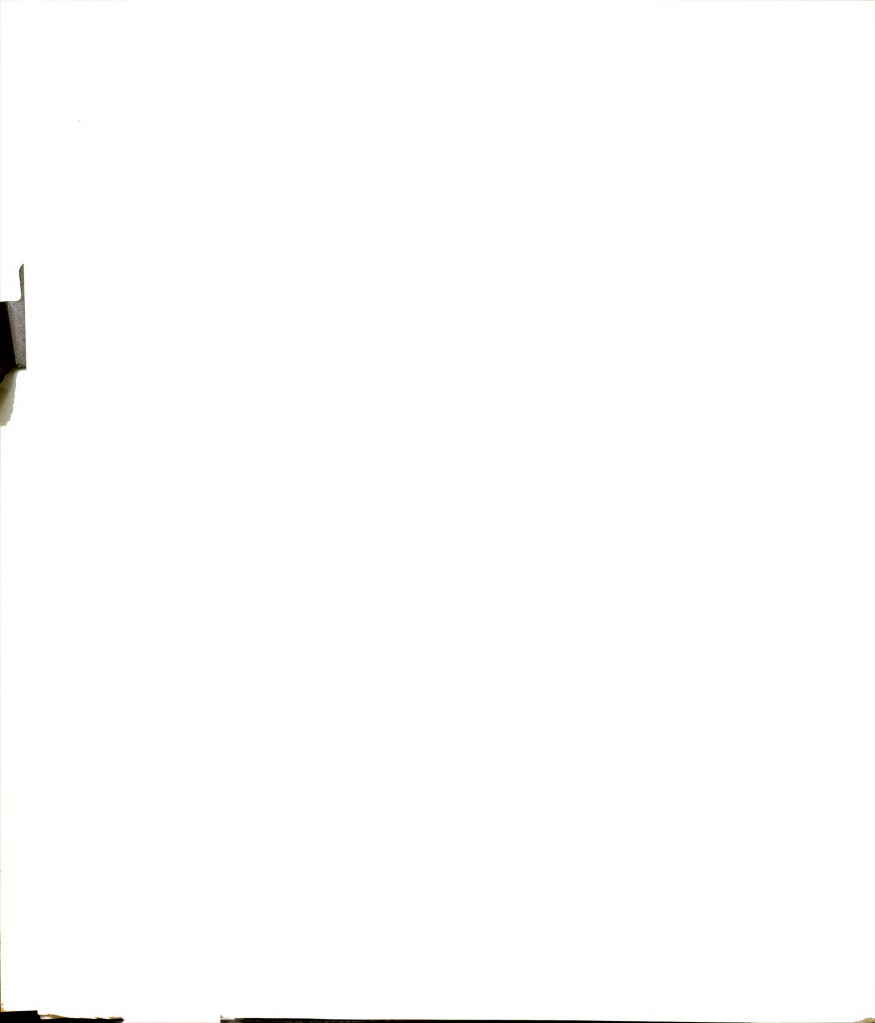
Figure 3.6. Index of Seasonal Variation.



variations. Intensity of demand for fertilizer has the tendency to vary with the degree of availability of complementary inputs, i.e., irrigation water, farm credit, system of land tenure, availability of improved seeds, and type of soil. Some of the reasons for higher demand for fertilizer in the districts of Multan, Sahiwal, and Lyallpur are the availability of public and private sources of irrigation, greater responsiveness of crops to fertilizer, a better soil, and good farming practices. Agronomically, there exists a close complementarity between fertilizer use and irrigation water for crop production. Fertilizer consumption is, therefore, likely to be high in areas where there exists a regular and dependable source of water supply which permits an efficient water management and yields a reliable source of permanent income stream to an investible input like fertilizer. The level of fertilizer use would be lower in areas where rainfall feeds an irregular and low-volume of water supply with a considerable degree of variation and uncertainty in the returns to farmers' investment.

Availability of Irrigation Water

A vast publicly-owned and managed irrigation system of Indus, with its gigantic barrages and huge main canals, a proliferation of link canals, and innumerable distributary outlets constitutes the backbone of the



economy of West Pakistan. The costly and publicly-owned system of irrigation of West Pakistan is subject to heavy political pressures to bring more acreage into the system and distribute inadequate water supplies equitably regardless of the considerations of optimum water use. The supply of canal water tends to remain inelastic, in the short-run, because of the high fixed and variable costs involved in augmenting the existing water supplies either by the construction of new canals and dams or by expanding the laterals of existing canals which are, in turn, subject to considerations of technical and economic feasibility. The high cost of canal water should lead to an intensive use of irrigation water because the spreading of water too thinly results in an unwanted loss through seepage and evapo-transpiration. On the other hand, water requirement for the soils of West Pakistan is high, because of the presence of salts in the soil and greater evapo-transpiration potential. The water discharge of West Pakistan rivers generally begins to increase in April culminating in high peaks in July and August after which the flow abruptly decreases reaching a low, but fairly constant level from October to March. About 80 percent of the annual river flow occurs during the six summer months (Kharif) and only 16 percent during the six winter months (Rabi). Nearly 44 percent of the flow occurs during July

and August.³⁵ Due to lack of adequate storage facilities, farmers are dependent for their irrigation water on variable and unpredictable river flows which cannot be timed to coincide with crop growing seasons.

While irrigation is a capital intensive endeavor, one million acres constitute the critical minimum size for an irrigation project. In spite of favorable rates of return to investments in irrigation projects, the cost per acre foot of water for the farmer tends to be high for the low income farmer, canal water is therefore supplied at subsidized rates.

However, canal water charges are very low compared to the cost of pumping water from tube wells. Canal water rates tend to vary with the type of crop grown by the individual farmer. In order to estimate the cost per acre foot of water, a rough estimate of the amount of water used by each crop is shown in Table 3.6.

Canal water rates vary from \$1.01 to \$4.54 per acre cropped or between \$0.57 and \$2.79 per acre foot of water delivered as compared to \$3.44 per acre foot of water pumped from electric tube wells and \$4.58 per acre foot of water pumped from diesel tube wells.

³⁵ Harza Engineering Company International, Programme for Water and Power Development in West Pakistan, 1963-75.

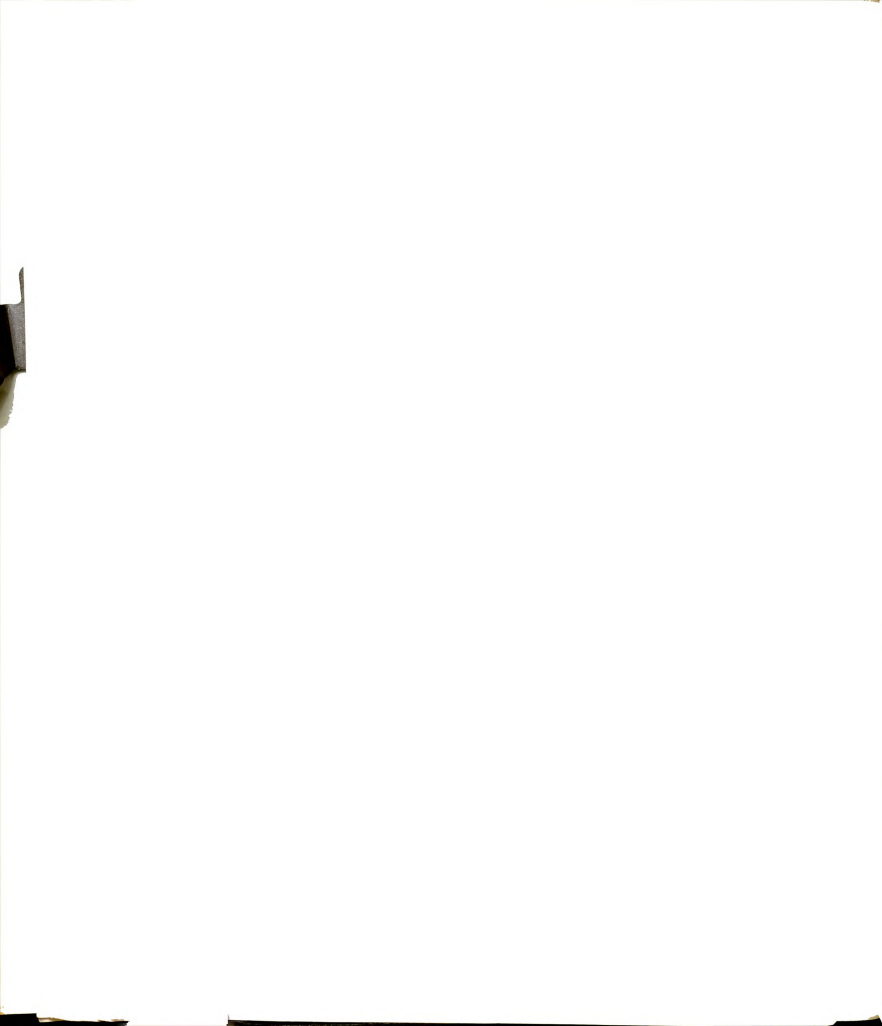


TABLE 3.6. Canal Water Charges for Different Crops.

Crop	Water Rate Per Acre Cropped (Rupees) ^a	Estimated Water Use (Acre Feet)	Water Rate Per Acre Foot of Water (Rupees) ^a
Sugarcane	21.6	4.4	4.9
Rice	10.4	3.8	2.7
Cotton	10.4	2.2	4.7
Maize	6.4	1.6	4.0
Wheat	6.4	1.1	5.8
Oilseeds	8.0	0.6	13.3
Grain	4.8	0.8	6.0

^aOne rupee = \$.21.

Source: Harza Engineering Company International, Programme for Water and Power Development in West Pakistan, 1963-75.

The evidence that West Pakistan faces scarcity of irrigation water is reinforced by the fact that canal water supply is much lower than the water requirement of various crops for an optimum rate of fertilizer use and the rate of water use required to attain a desirable level of cropping intensity. The present canal water supply provides about 1.8 acre feet per acre at the heads of water courses. Though the British-designed canal system of West Pakistan provides for a cropping intensity of about 25 to 30 percent in Kharif and 50 to 55 percent in Rabi, Harza Engineering International propose an intensity of cropping of 60 percent in Kharif and 80 percent in Rabi, and an overall



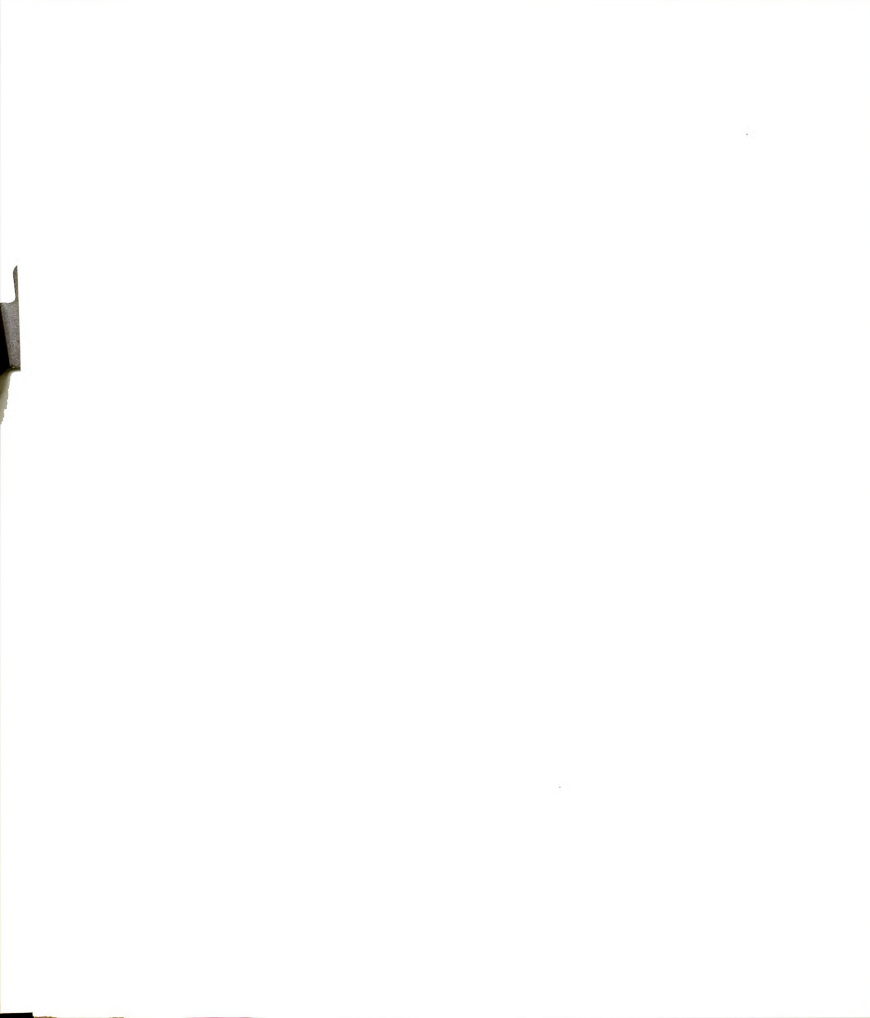
cropping intensity of 140 percent.³⁶ The water requirement desirable for attaining the proposed level of cropping intensity is estimated to vary from 2.98 acre feet per acre to about 4.72 acre feet per acre in various canal systems in the former Panjab. The overall average for the Panjab canals comes to about 4.0 acre feet per acre. The deficiency in canal water supply is thus estimated to be about 2.2 acre feet of water.

One basic cause of lower average yield of crops in the irrigated areas of West Pakistan is the much lower availability of irrigation water than would be required for consumptive use of crops. A comparison of the level of water use indicates that one cusec of water is generally supplied for 350 acres in West Pakistan, as compared to 70 acres or less in the United States and other countries under similar climatic conditions. Since there is a general scarcity of irrigation water, major improvements in the productivity of agriculture can be expected from the use of additional water on the lands presently irrigated with inadequate water supplies.

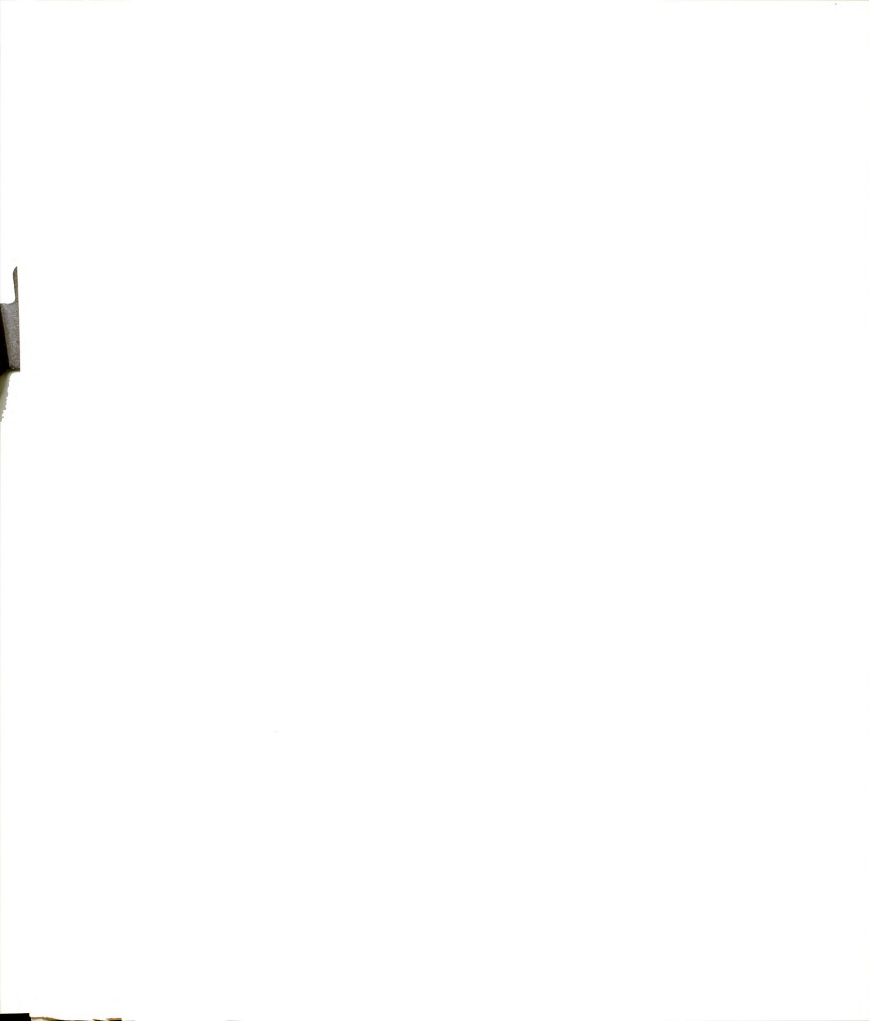
Irrigation Water Supply by
Tube Well Development

A major advance in relieving the scarcity of irrigation water in West Pakistan has been made in groundwater development by the installation of tube wells. A

³⁶ Ibid.



remarkable feature has been the recent growth of both public and private investment in tube wells. A comparative cost analysis of public and private tube wells indicates that the net cost per tube well of one cubic capacity installed by WAPDA is much higher than the capital cost of a private tube well of similar capacity and the capital costs of a diesel-powered tube well are higher than those of an electric-powered tube well. Since the cost of installation as well as the annual cost of pumping water from electric-powered tube wells is much lower, a rapid development in tube well installation may be expected, if electricity is made available to non-saline groundwater areas. As against canal water supply, the system of private tube well irrigation has much lower fixed and variable costs associated with low cost of private entry. Because a private tube well owner faces a relatively elastic supply of irrigation water and is not handicapped by considerations of equity, he can optimize the use of water by equating the cost of additional water input to the revenue derived from additional output. The pattern of private tube well development in West Pakistan indicates that tube wells have been installed by cultivators with twenty-five acres or more, but 20 percent of the installations by 1965 had been undertaken by town investors who had little or no land and who earned return by selling water to small cultivators. Statistical



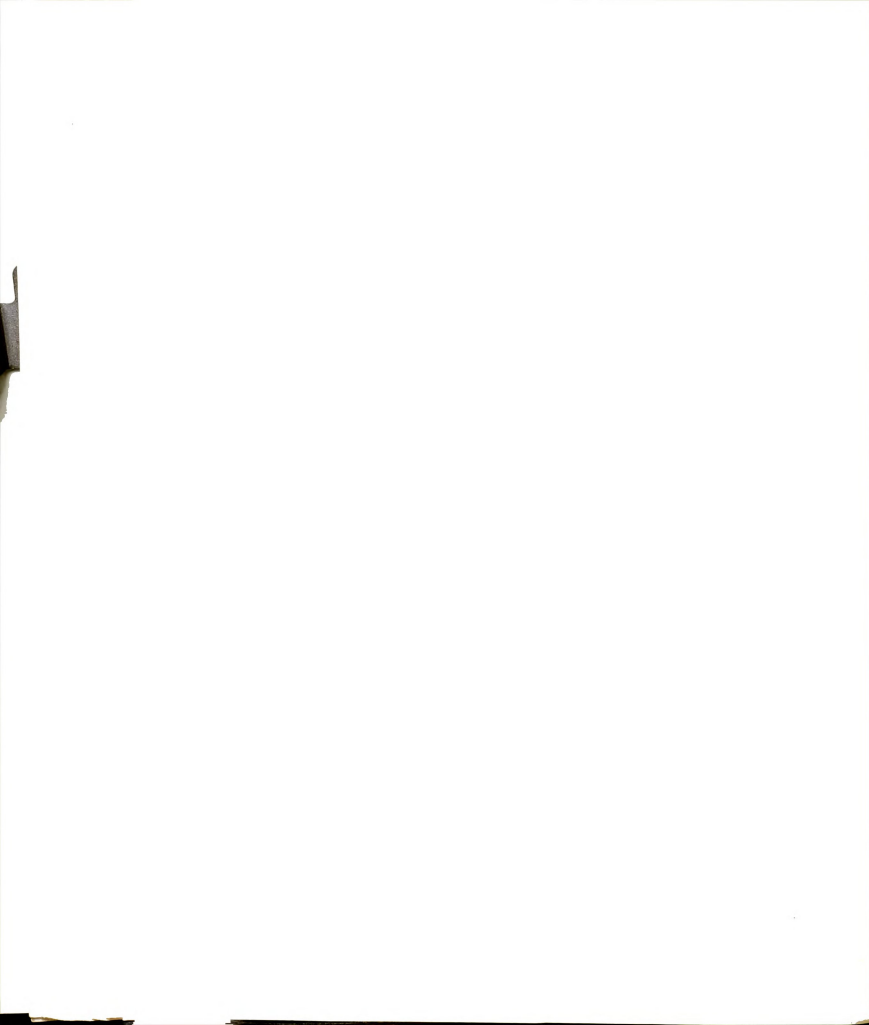
evidence verifies the fact that the level of fertilizer use per acre increased from 0.4 bags per acre for non-tube well farmers to 0.9 bags of fertilizer per acre for tubewell farmers. With higher level of water use per acre varying percentage of increases in yield could be expected. The following increases in the yield of various crops for 30 to 40 percent additional use of water were noticed in the non-saline groundwater areas of Multan and Montgomery.

TABLE 3.7. Increase in Crop Yields Due to Additional Water Use.

Crop	Increase in Yield	
	Maunds Per Acre ^a	Percent
Cotton	3.0	30
Rice	2.5	25
Sugarcane (gur.)	8.0	21
Maize	3.0	22
Wheat	3.0	22
Fruits and Vegetables	15.0	21
Oilseeds	1.3	20
Grain	1.6	20

^aMaunds = 82.266 pounds.

Source: Harza Engineering Company International, Programme for Water and Power Development in West Pakistan, 1963-75.

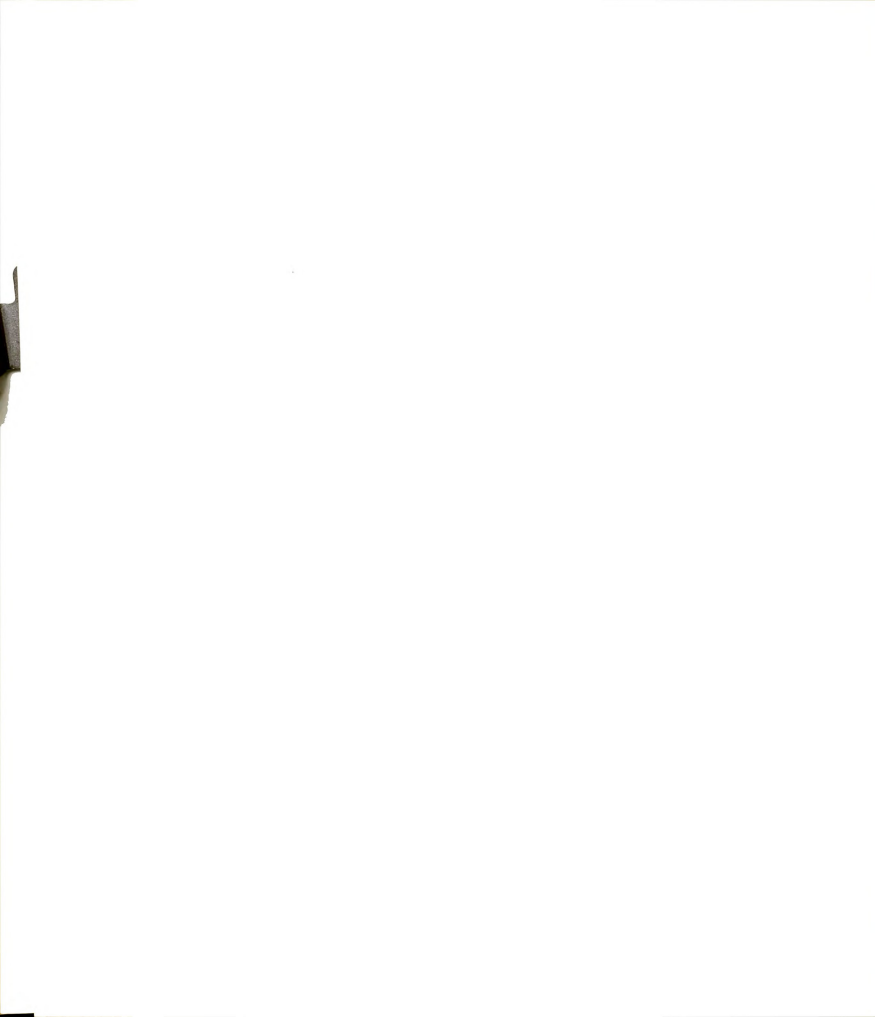


A comparison of the gross income for 100-acre non-tube well farmer with the gross income for a 100-acre tube well farmer in the irrigated areas of Multan and Sahiwal districts indicates that the gross income per acre for a non-tube well farmer is \$54.20 per acre as compared to \$69.33 per acre for a tube well farmer and is associated with an increase in cropping intensity by 32 percent. With greater availability of irrigation water, efficiency of bullock use, and productivity of farm labor is likely to increase, because of increased intensity of cropping.

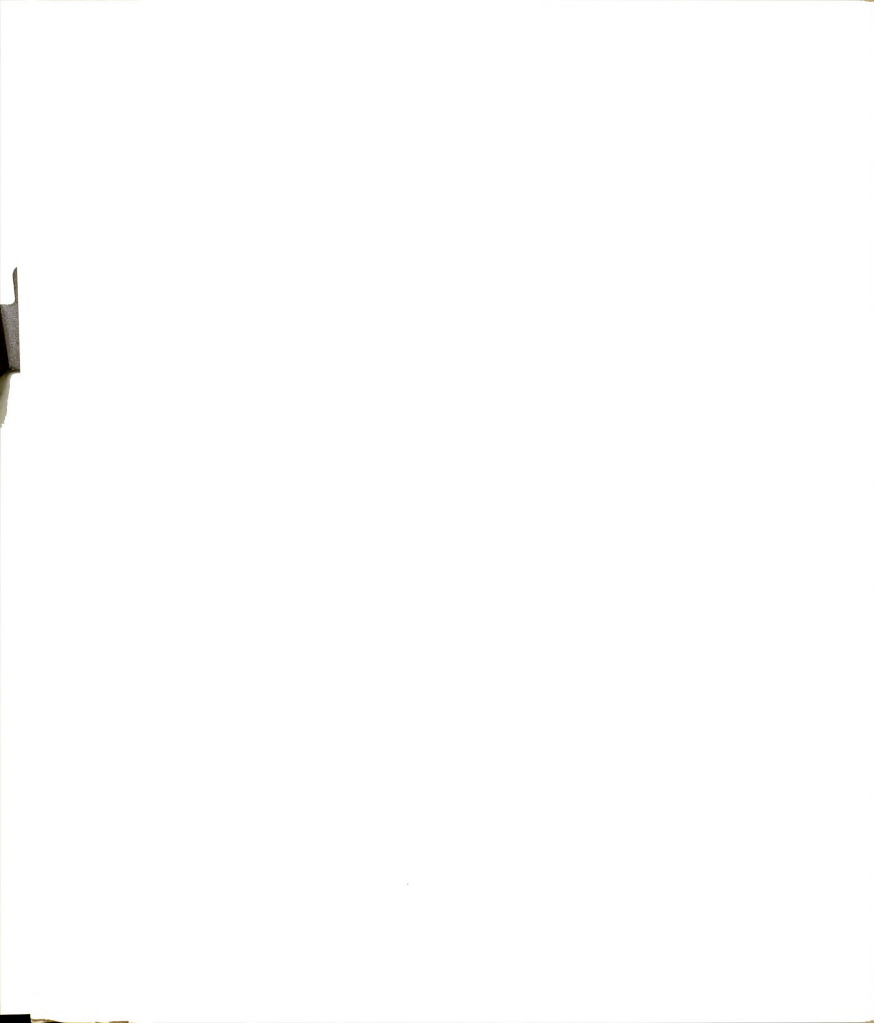
Since the sinking of private tube wells, apart from creating private returns generates social costs in the form of exhaustion of aquifers, the hazards of water-logging and salinity, the depth and quantity of water pumped by private tube well owners must be controlled by the government through licensing arrangements. The operation of tube wells is subject to significant economies of scale and the cost per unit of water supplied is likely to be less, the larger the well, the greater would be the area commanded. Thus in an area characterized by small holdings, tube wells would be of less than optimum size.

Provision of Agricultural Credit

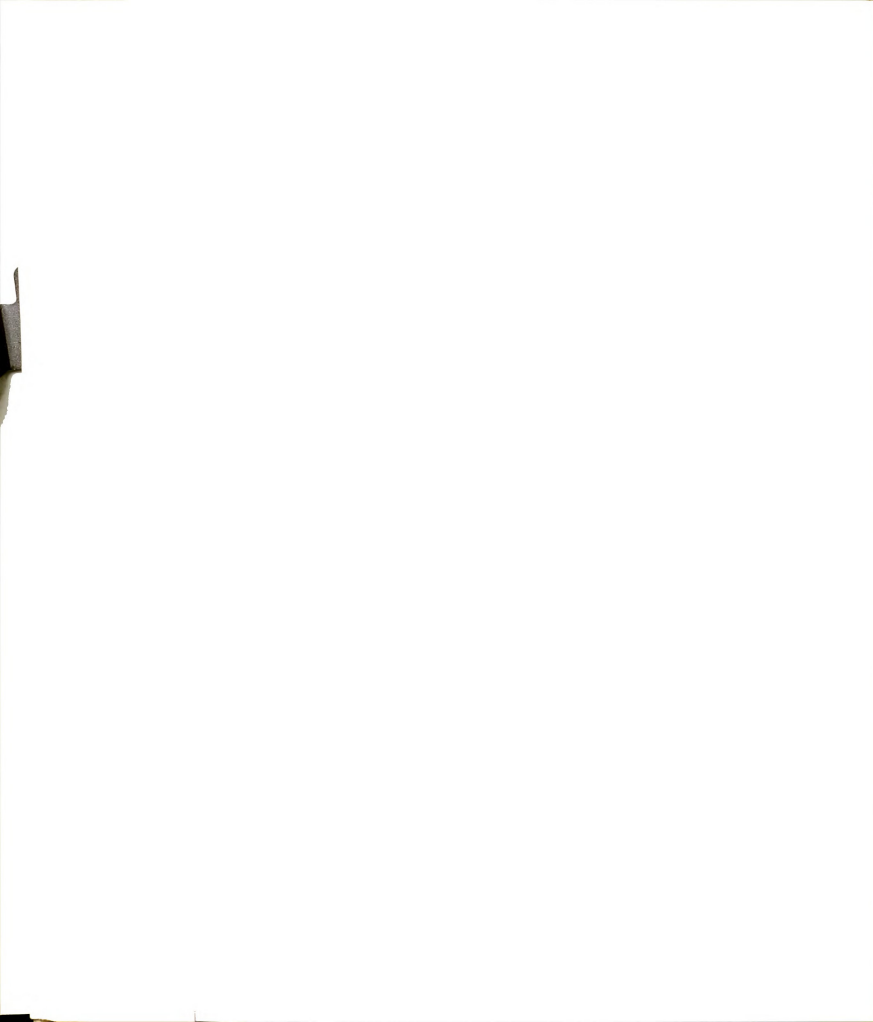
The farm credit requirements in West Pakistan are distinctly seasonal. This may be partly due to the farmer's need for credit at the sowing time when a variety of farm inputs like seeds, fertilizers, hired labor, and irrigation



water are purchased and the harvested crop is either to be stored or shipped to the market and partly because of the inability of the farmer to save the proceeds of the harvest until the following planting season. On the whole, the liquidity position of the farmer is very poor, because of the small holdings, low farm income, low saving habits, and an outdated system of tenancy. Despite the acute need for farm credit, there exists a reticence among farmers to borrow money for agricultural inputs that may be due to the necessity of pledging title to their land as a collateral. Such a system of security requirement categorically excludes the landless farmers from access to credit and acts as a deterrent to others who run the risk of pledging their entire property for the purchase of fertilizers. Whereas a farmer faces a variety of risks in the form of weather, price variation, and yield uncertainty, the adoption of an innovation like fertilizer with stiff security requirement for credit may tend to negate whatever positive gains can be expected from the use of this new input. It is, therefore, suggested that all such "supervised loans" should be made in kind, i.e., in the form of actual inputs and should be tied to farmer's performance or increased production potential of the input rather than to the security of land or other assets. To facilitate loan recoveries, the provision of credit may be tied up with marketing.



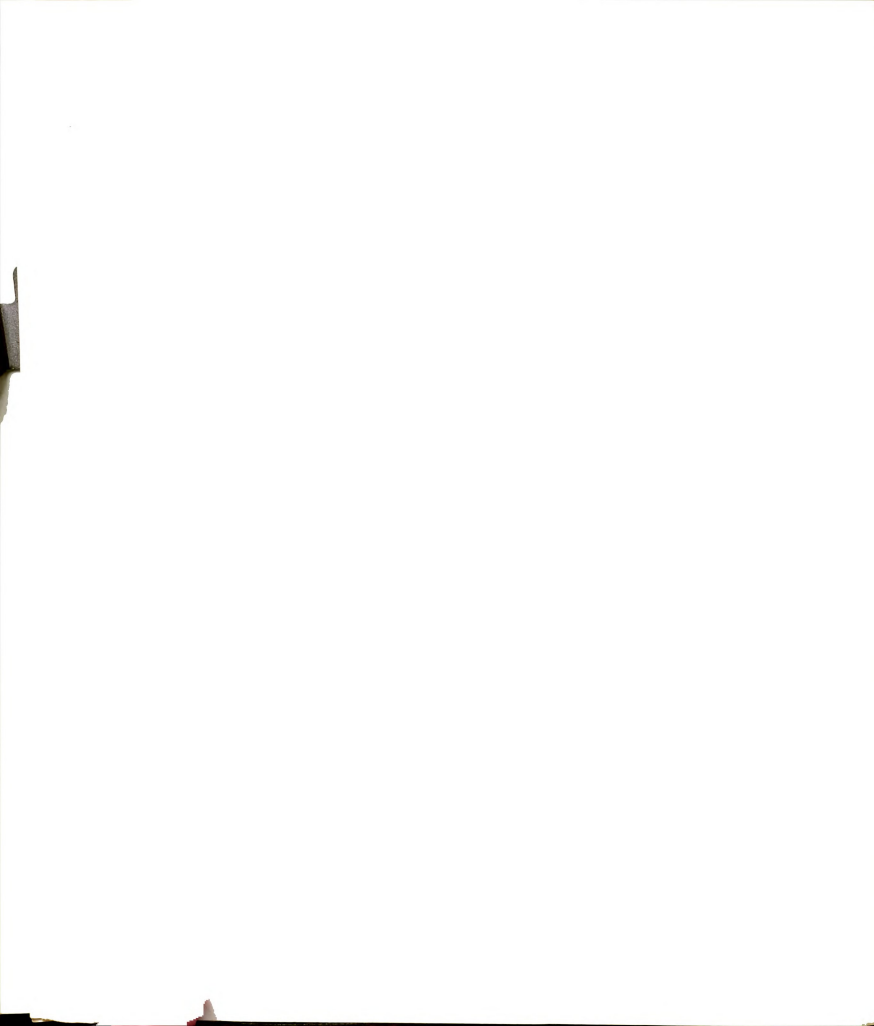
In general, there are three types of production credit that are advanced to farmers: short-term production credit for a period of a year or less; medium-term for more than one, but less than five years; and long-term credit for five years or more. Stimulation of demand for fertilizers would essentially require the floating of short-term credit. On the supply side of agricultural credit, there are various sources of formal and informal credit that administer short-term loans to farmers in West Pakistan. Among the formal sources of credit supply are cooperative banks, agricultural development bank, private commercial banks, Taccavi loans advanced by the revenue department, and various fertilizer distributing agencies. On the other hand, among informal sources of credit supply are the village shopkeeper and the traditional money lender who have some operational advantages of intimate familiarity with the borrower, readiness to grant risky loans, quick and low-cost loan management, and a high rate of loan recovery, but their monopoly position in the village can place them in a position to exploit the farmer. Since the farm credit requirements for the agricultural sector as a whole are enormous, maximum gains from the available supply of loanable funds can be obtained by advancing short-term loans channelled primarily to meet the financial needs of a new input. Short-term and medium-term loans involve a high rate of turnover of loanable capital within a



comparatively short period of time. From the borrower's point of view, it will be used in the practices which yield the highest relative rate of return and have a short maturing period. On the other hand, it would be ill-advised to tie up a substantial part of current capital funds in long-term loans secured for farm real estate. Purchase of real estate where possible may be made over a period of years from the proceeds of crops harvested. Apart from big landlord and peasant proprietors, a major proportion of farmers are small cultivators with very limited resources who present varied and complex problems for the development of institutional credit in West Pakistan. Since the adverse liquidity position of small farmers is likely to emphasize the importance of meeting financial obligations, it will be necessary to advance loans in kind and collect them in kind.

The 1960 Census of Agriculture showed that 48 percent of the farmers in West Pakistan were under debt which constitutes 29 percent of the farmers in West Pakistan. The total amount of debt of agricultural population was estimated recently to be \$2.7 million in West Pakistan.³⁷ A sample survey conducted by the Central Statistical Office during the second plan period to

³⁷Government of Pakistan, Ministry of Food and Agriculture, Census of Agriculture, 1960.



determine the sources and uses of credit indicated the following percentage distribution of sources from which cultivators borrowed.

TABLE 3.8. Various Sources of Agricultural Credit for Farmers.

Source	Percentage of Cultivators
Friends and relatives	73.3
Landlords/employers	15.1
Shopkeepers	4.1
Cooperative societies	0.8
Agricultural banks	0.9
Commission agents	1.6
Others	0.1
No response as to source	4.1

Source: Government of Pakistan, Credit Enquiry Commission Report (Karachi: Manager of Publications, 1960).

The survey further points out that 44.9 percent of the cultivators in West Pakistan received an average cash loan of \$115.12. Only 5 percent of the cultivators borrowed cash to be repaid in kind. The average cash loan taken for repayment in kind was \$74.58 in West Pakistan whereas the average imputed value of crops paid on loans taken in cash was \$89.29. This collective information indicates that nearly 50 percent of the credit secured



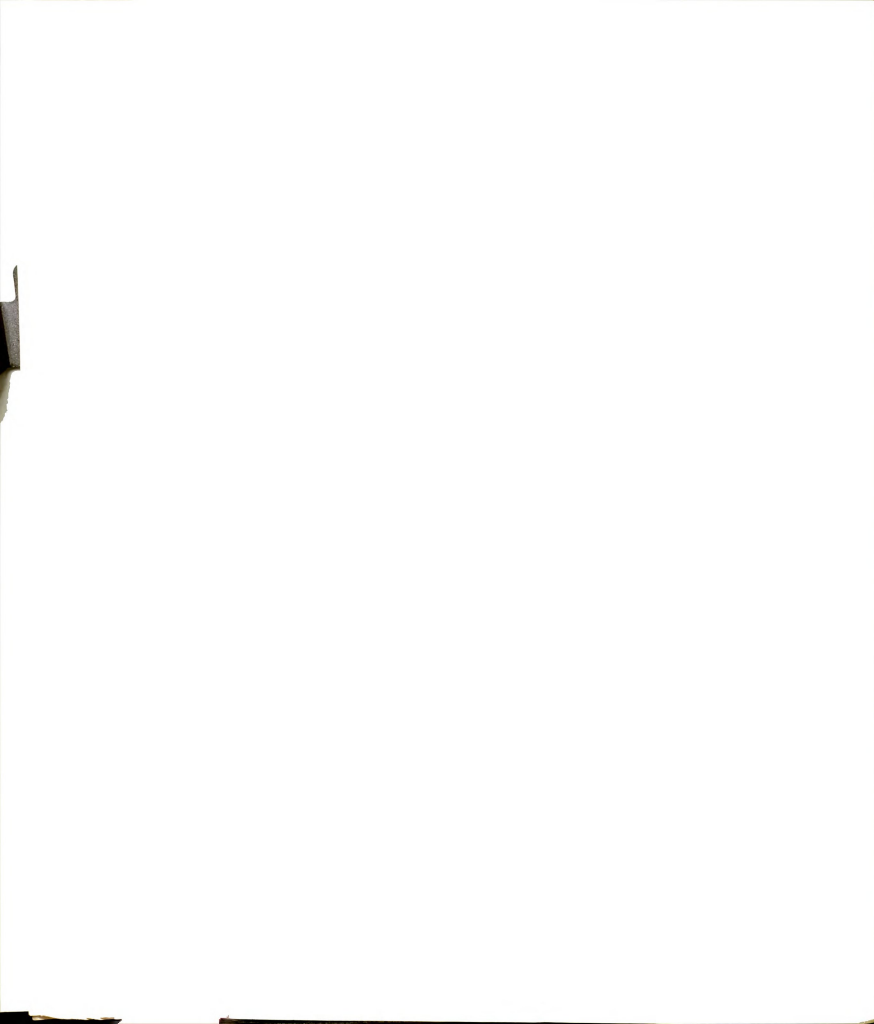
was for non-productive uses and that a high rate of interest of over 60 percent was paid on production loans.

The total amount of credit administered by three main sources of institutional credit--Board of Revenue, Cooperative Departments, and Agricultural Development Bank of Pakistan--were of the order of \$150.2 million. Whereas the third plan (1965-70) credit target of three agencies is of the order of \$285.7 million, an agency-wise breakdown of the total credit for agriculture advanced during the second plan and target for the third plan is as follows:

TABLE 3.9. Agency-Wise Breakdown of Agricultural Credit During the Second and Third Five Year Plans.

Agencies	Credit During Second Plan (Million \$)	Credit Targets for Third Plan (Million \$)
1. Revenue Department	138.7	21.00
2. Agricultural Development Bank	43.3	107.90
3. Cooperative Department	<u>93.0</u>	<u>157.57</u>
	150.23	286.45

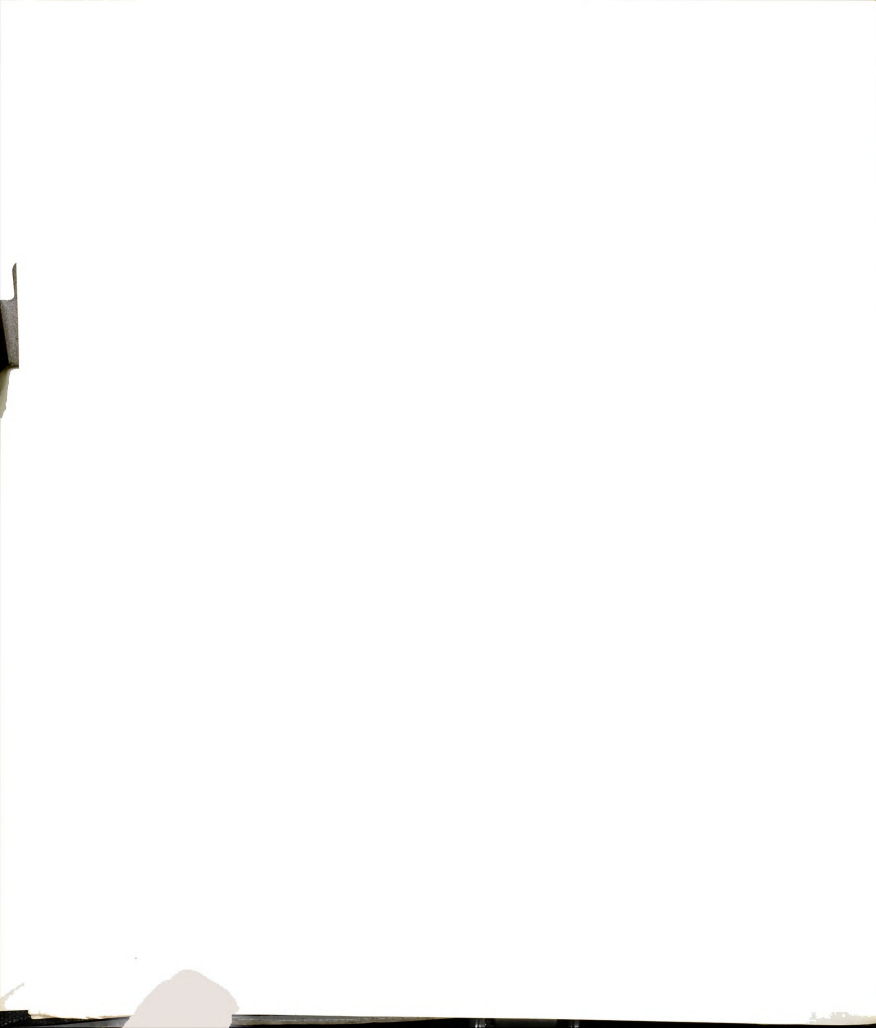
Source: Government of West Pakistan, A Program for the Attainment of Self-Sufficiency in Foodgrains During the Third Plan (Lahore: Planning and Development Department, 1966).



As a loaning agency, the cooperative department remains the major single contributor. The magnitude of loans advanced by this agency during the second five year plan constituted more than 50 percent of the total agricultural credit and is expected to maintain its rising trend during the third plan period as well.

Another interesting source of farm credit in West Pakistan is the private commercial banks which have proliferated in multiple branches throughout the country. One way to encourage more credit would be for the government to underwrite or guarantee loans made by the private commercial banks to farmers for specific purpose through the State Bank of Pakistan. In this way, the government would assume risks beyond what is considered normal, and the private banks, thus operating in a reduced risk environment, can offer credit at attractive rates. A distinct characteristic of such loans is the high default rate which has historically occurred with various types of farm loans. In this case, government as the legal and most effective authority should proceed to assess the defaulted principal as areas of taxes owed by the defaulter. Collection would then be pursued by the normal tax collection mechanism spread over two or three years.

Since the liquidity position of low-income farmers in West Pakistan is very poor, a program for the distribution of fertilizers could only be made effective through the supply of agricultural credit. An estimate of the



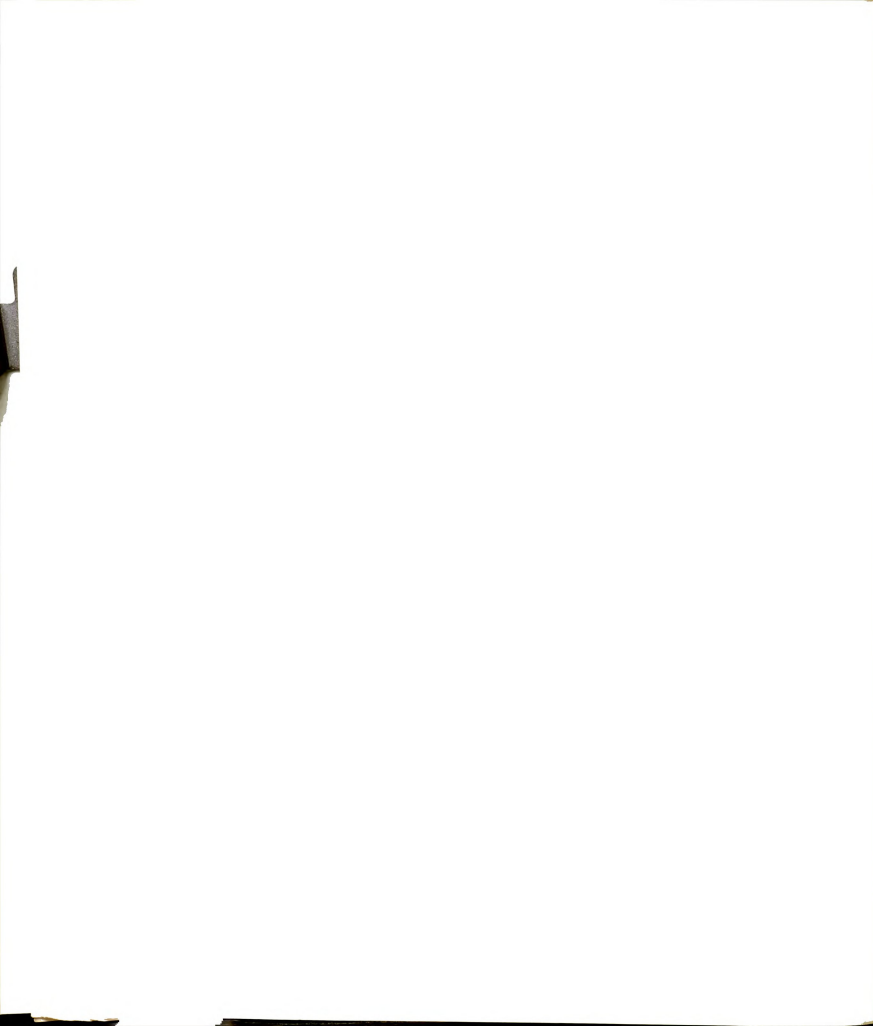
total credit requirements for fertilizer application in West Pakistan for the year 1969-70 in connection with the program of food self-sufficiency is given below.

TABLE 3.10. Requirements for Agricultural Credit on the Basis of Farm Size.

Description	Farms of 25 Acres & Above	Farms From 5 to Under 25 Acres	Farms Under 5 Acres	Total
Cropped area (million acres)	11.8	22.6	4.6	39
Fertilizer appli- cation (in bags per acre)	1.7	0.8	0.5	1.03
Total fertilizer application (in million bags)	20	18	2	40
Amount of credit required (in million \$)	--	\$60.5	\$6.7	\$67.2

Source: Government of West Pakistan, A Program for the Attainment of Food Self-Sufficiency During the Third Plan (Lahore: Planning and Development Department, 1966).

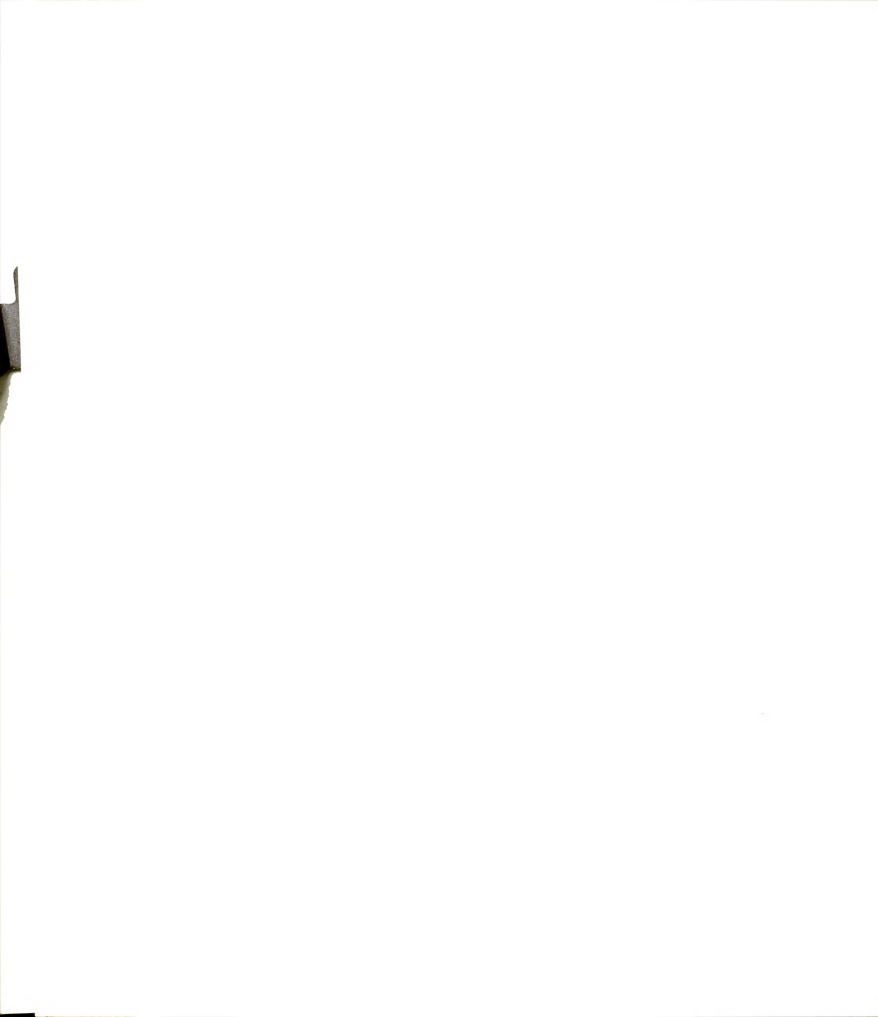
The available data show that the credit requirement of farmers for the purchase of fertilizers varies with the size of farm. The credit needs of medium size farmers tend to be greater than those owning twenty-five acres and above on very small farms of five acres and below. The rationale for the greater need of medium size farmers for "supervised loans" seems to be the low-level of farm



income, and high propensity to use new inputs yielding higher permanent income streams and adverse liquidity position of such farmers. The loans can be floated on barter basis, i.e., loans advanced in kind and recovered in kind. In order to reduce the possibilities of over-charging and to ensure a reasonable price to farmers, it will be advisable to provide storage service to farmers at a nominal charge. A chain of public or private warehouses may give the farmers negotiable warehouse receipts so that farmers may market their produce whenever they can get a good price for it. The current practice of charging a uniform interest rate for all short-term official credit advanced for a wide range of objectives needs re-examination. The introduction of differential interest rates on loans for different purposes might improve the use of loan funds and recovery rates.

Land Tenure as a Determinant of
Fertilizer Consumption

The extent to which a farming system can attain efficiency of resource allocation depends on the manner in which land is held by the operators. Farm tenancy is a special case of a general problem that arises under a given system of land tenure, when the resources used by the firm are controlled by different people. In case of tenancy, the standard of comparison being the owner-operator, tenure agreement should permit the tenant to



use the available resources in the same manner as the owner-operator or to attain production efficiencies possible in the absence of binding tenure agreements.

With all the various forms of land tenure prevailing in different regions of West Pakistan, landlord and the tenant typically share the output on a fifty-fifty basis. The tenant pays the cost of the package of inputs, but receives only a share of the increased output. The landlord benefits from increased output while contributing almost nothing to variable costs of production. Consequently, the incentive for share-cropper tenant to use fertilizer is considerably less than that of owner-operator who gets full returns for financing the variable costs of an input. Two common rental methods are the cash rent and the crop share rent. One important consequence of renting out is that risk may be shared. A cash rental requires a fixed sum be paid each year; a share lease permits the landlord to be paid a fixed portion of total product. Given perfect certainty, a renter would be indifferent to the two methods of leasing only if the payments over time are identical. Otherwise, he would prefer the one resulting in the smaller payment. In fact, however, perfect certainty is absent and the cash rental places all risk on the operator. In that situation, the operator would rationally accept a cash base only if it resulted in lower payments over time, the size of

differential being a function of the risk in that particular farming area.

If the tenants risk preference is such that he will assume added risk only at the prospect of an increase in income, he is in some sense "worse off" than he would be as an owner-operator when the cash rent exceeds the costs of land-ownership. Since in the long-run, landlord would not rent at a rate less than the cost of land ownership, the cash tenant can never be better off than the owner-operator. Cash rent is a fixed cost to the operator and he will purchase and allocate resources exactly as an owner-operator. The average variable cost and marginal cost curves will be identical for the cash tenant and owner-operator (Figure 3.7). At product price P_1 , both

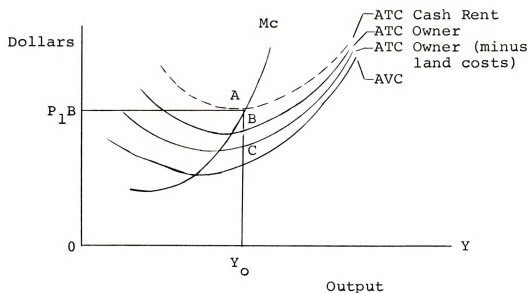
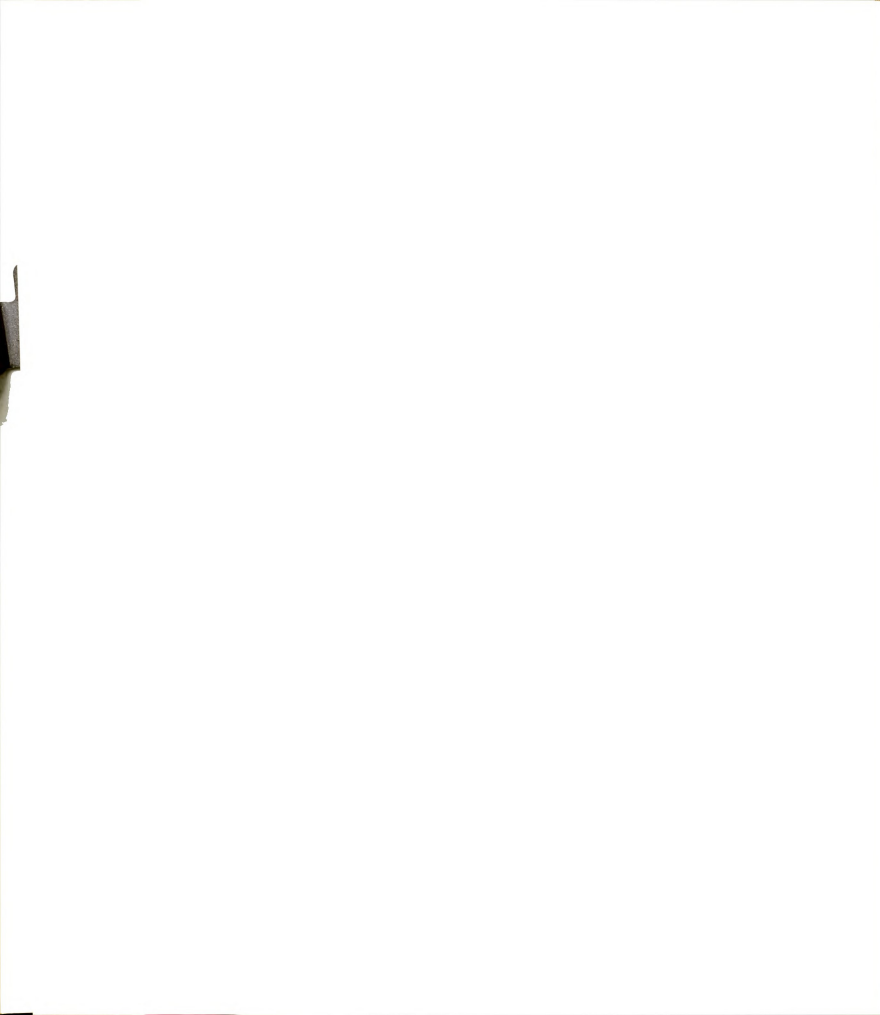


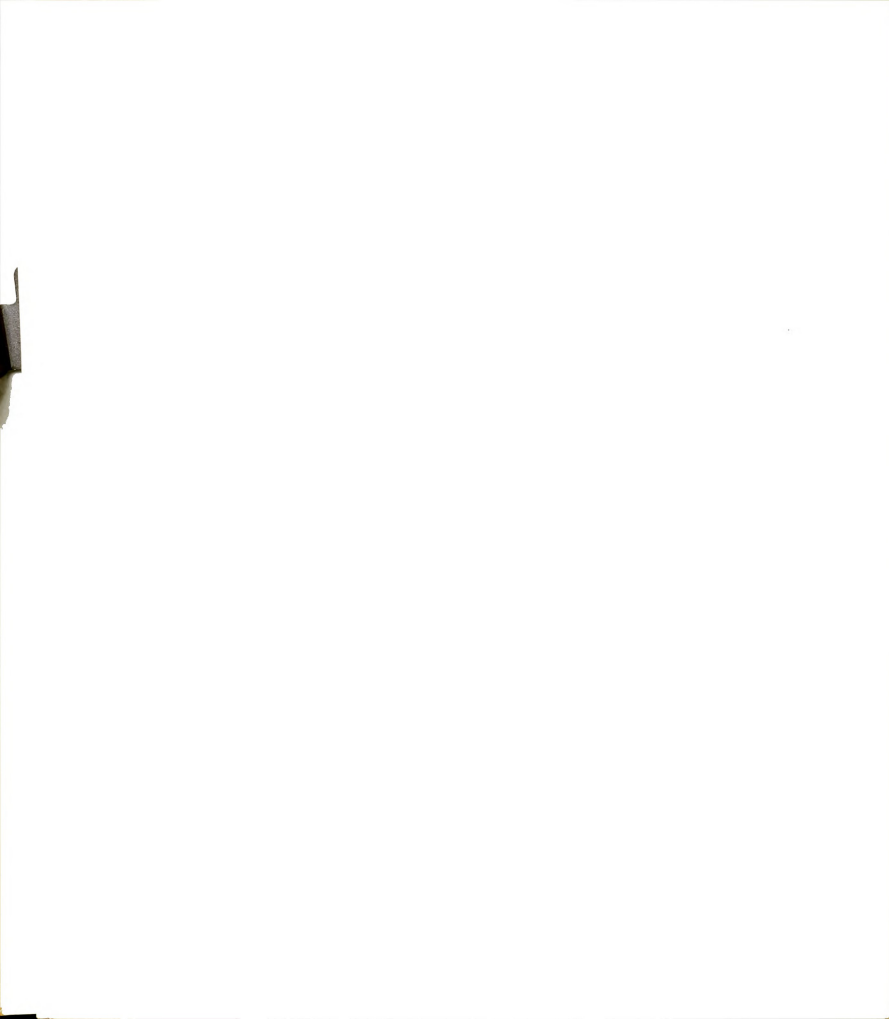
Figure 3.7. A Case of Cash Tenant Versus Owner Operator.



would produce a total output of Y_0 . If the owner-operator had an average total cost of ATC, there would accrue to him as a landowner an economic rent of amount AB. The landlord would thus want to charge a cash rent at least equivalent to the economic rent. But the owner-operator's ATC also includes the costs of land ownership. If he did not own land, there would exist a lower ATC curve excluding ownership costs which would represent the minimum cost level at which he would stay in business in the long run. That is, the lower ATC curve includes as costs all imputed returns necessary to keep all non-land resources in farming. The landlord would thus want to charge the economic rent, AB, plus the costs of land ownership represented by BC or a total of the distance AC. When he does, the cash renter's costs will rise to ATC cash rent. If the farm were on the extensive margin, AB would be zero.

With crop share lease, the tenant and the landlord both assume a share of the risk, but conflicts may arise when costs of variable inputs are also not shared.

Figure 3.8 depicts a situation in which the tenant pays all the costs of a variable input, X , and the landlord receives one-third of the output. With input price, C , an owner-operator would use X_2 amount of X and make a profit represented by the triangle (ACF). The tenant, however, would only apply amount X_1 and would thereby





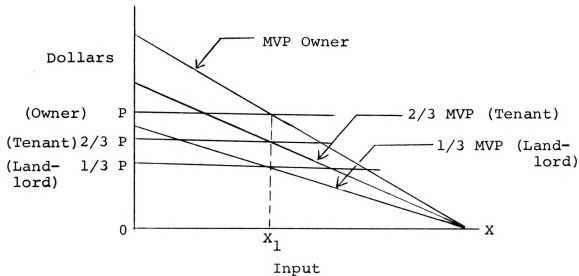


Figure 3.9. A Case of Tenancy Under Which Both the Landlord and Tenant Share the Input Costs.

optimum amount of input, to which they both agree is X_1 , the amount an owner-operator would use. While the tenant's profit is increased by cost-sharing, the landlord's profit may not be, particularly if he can convince the tenant to use more than the amount X_2 as indicated in Figure 3.8. Thus, while cost sharing provides for the most efficient use of resources, it may not be the most profitable for one of the two parties.

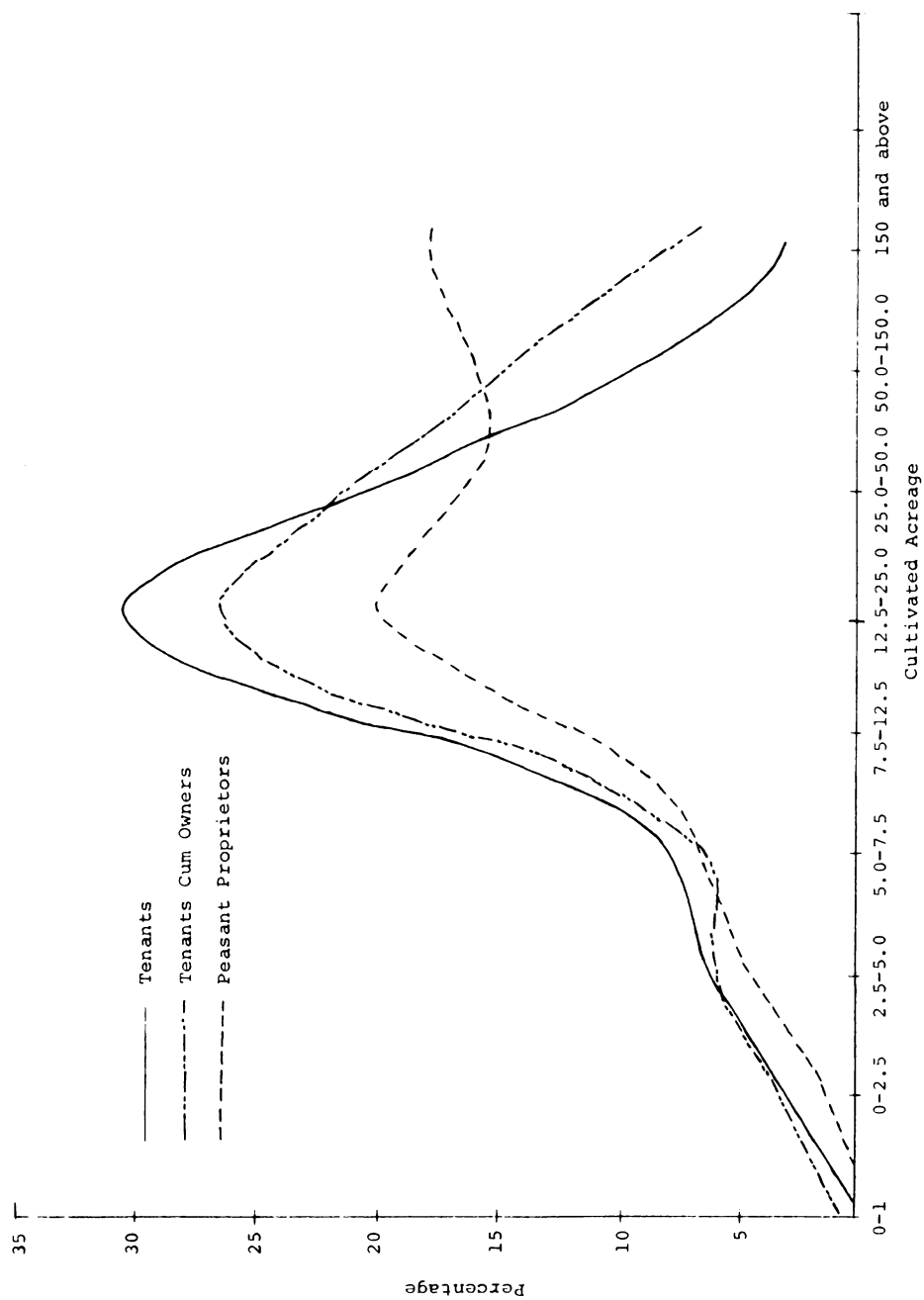
A classification of cultivated area by type of tenure shows that almost 51 percent of the cultivated area in West Pakistan is under the active operation tenants. Any program aiming at stepping up farm productivity cannot overlook the major portion of acreage operated by tenants.



The existing system of land tenure does not encourage the effective adoption of an innovation by farmers, because of uncertainty and variability in farmers' returns, the costs of which may be borne by the tenant only. Since the percentage share of the tenant and the procedure of dividing the harvested crop is not legalized, the tenant invariably gets a low return to this investment. Insecurity of tenure may reduce the incentive of tenants to make investments for the improvement of farms that might enhance the crop response from fertilizer and thus make its use more profitable.

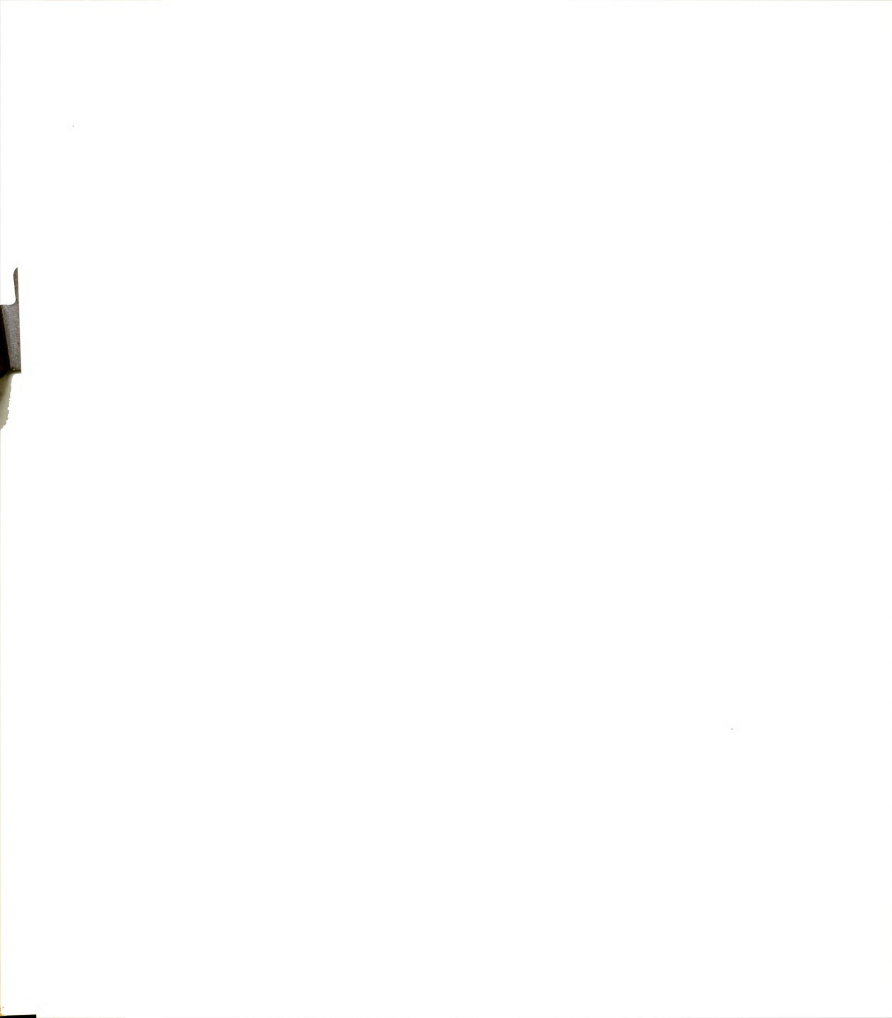
A graphical illustration of the percentage distribution of the cultivated acreage among tenants, tenant-cum owners, and peasant proprietors is provided in Figure 3.10. As for larger holdings one-third of the total cultivated area is accounted for by farms of twenty-five acres or above. In order to attain rapid increases in fertilizer use and immediate gains in food output, it would be advisable to concentrate the extension effort on larger farmers, thereby reducing the administrative costs of distributing fertilizers to fewer farm operators. The credit requirements of larger farmers are likely to be less, because of their higher income and better liquidity position.

Given an adequate motivation, the large farmers can effectively make use of the new inputs in a package



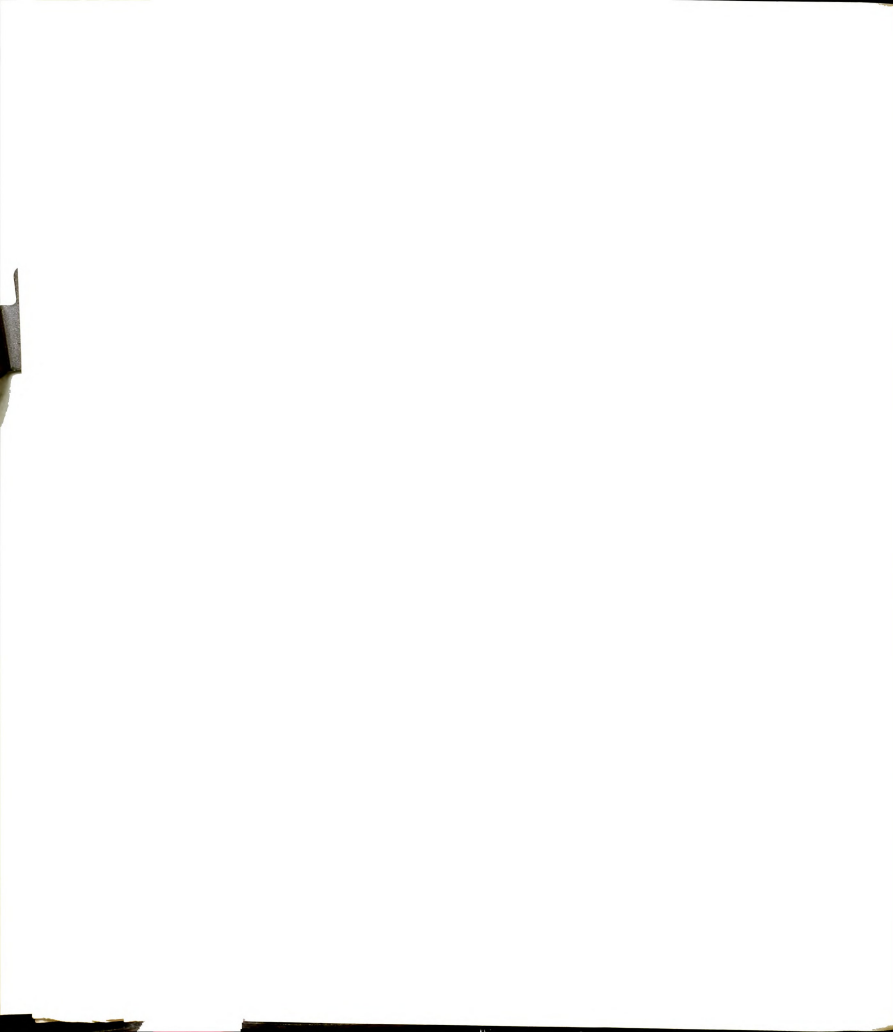
Source: Government of West Pakistan, Statistical Handbook of West Pakistan (Lahore: Bureau of Statistics, Planning and Development Department).

Figure 3.10. Distribution of Cultivated Acreage by System of Tenure.



form with lesser problems of resource proportionality. A sound credit position is likely to encourage them to make investments involving higher risks. The major problem remains with the smaller farmer who due to one reason or the other remains inaccessible to non-conventional inputs especially fertilizers, and does not share proportionally in the new gains in farm productivity in West Pakistan. A multitude of farmers owning 2.4 million farms below five acres account for 4 million acres of land in West Pakistan. An enormous extension effort would be required to make the new technology known and accessible to these farmers. Their weak risk-bearing position, limited financial resources, lack of managerial experience, and skill restrict him in the acquisition and effective use of new inputs. In addition to the rising factor prices there are some other forces that operate against the small farmer in the modern scientific-commercial setting which must be overcome if he is not to be squeezed and finally liquidated. Experience of Taiwan suggests that agricultural production increased by 85 percent between 1950 and 1965 on farms that averaged between 1.0 and 1.5 hectares through the joint efforts of government and farmers.³⁷ Similar experiences can be repeated in West Pakistan through

³⁷U.S. Department of Agriculture, Taiwan's Agricultural Development, Its Relevance for Developing Countries Today, Foreign Agricultural Economic Report No. 39 (Washington, D.C.: Government Printing Office, April, 1968).

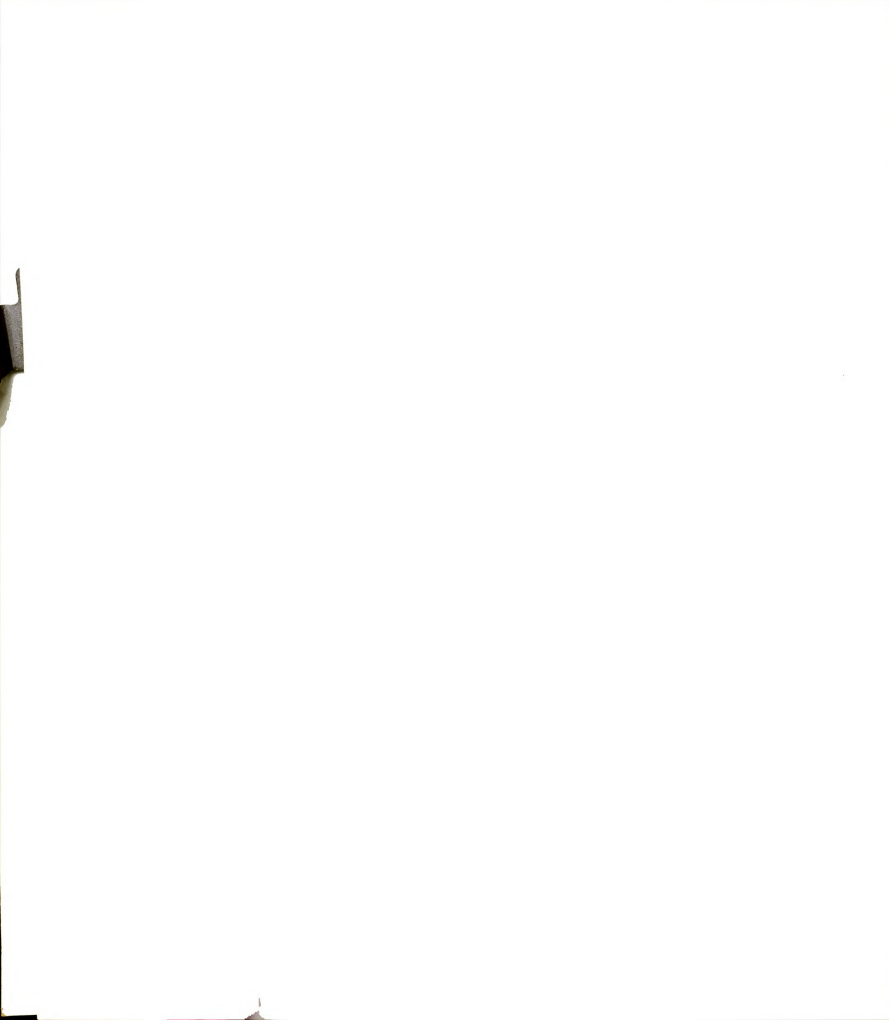


large-scale efforts of the government to enable the small farmer to survive the economic and technological forces operating against him.

The theory of fixed cash needs relates that subsistence farmers in poor countries operate on backward-bending supply curve of labor. If we assume labor hours as the only variable input, they will be prepared to put in extra hours of labor in order to attain a fixed real income and to compensate for generally rising prices. If we allow all other farm inputs to vary, the level of intensity on the small farm will be greater than the larger farm which is not subject to as much financial squeeze. Policies aiming at attaining a critical economic size of land-holdings by pooling together small holdings and eliminating inefficient farmers to capitalize on scarce managerial talent seem advisable.

Development of Improved Crop Varieties

The extent to which an average West Pakistani farmer will be motivated to purchase fertilizers depends upon his subjective projection function and his probability distribution for the expected permanent income stream arising from various doses of fertilizer. With a given price structure for farm inputs, an individual farmer is likely to substitute the use of fertilizers among various crops depending upon their relative benefit-cost ratios.



The factors that tend to be discounted in the decision-making process of a typical West Pakistani farmer may be the relatively small ratio of capital reserves, the opportunity cost of investible funds, and the uncertainty relating to outcomes of fertilizer use in the more distant future. With the emergence of new high-yielding varieties of Mexi-Pak wheat, Irri rice, and J-1 maize, the improved production possibilities have tended to shift the farmer's profit function thereby leaving a significant margin for the farmer's expectations about risk and uncertainty.

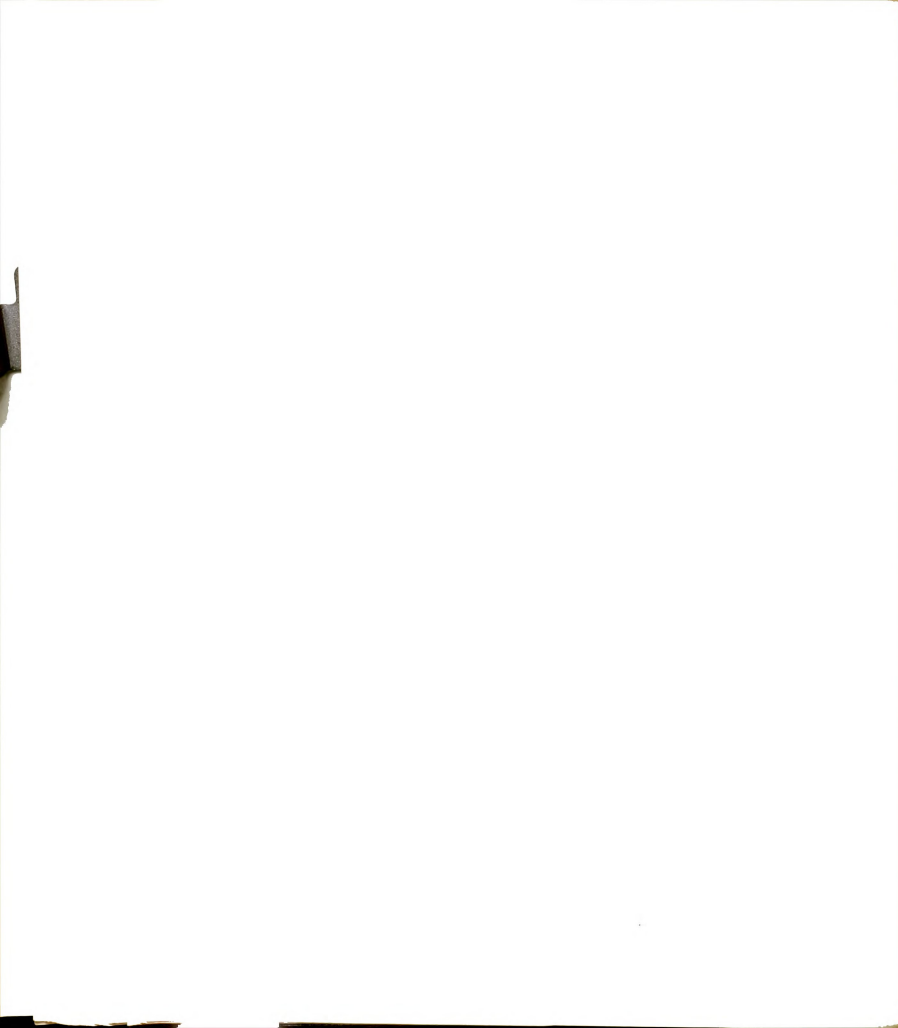
A striking feature of Mexican dwarf wheat is the short and stiff straw and the capability of converting large amounts of plant nutrients into a heavy load of grain without lodging. The chances of fertilizer use have greatly improved because of a favorable crop-response of 15-30 pounds for one pound of nutrient under commercial conditions as compared to 8 pounds of increased grain for each pound of N and P_2O_5 (nutrient basis). Top experimental yield of Irri rice in West Pakistan has been obtained at 164 bushels per acre as compared to 30 bushels for average commercial yield of local varieties. Similarly, introduction of J-1, synthetic maize on a limited commercial basis gave a yield of 60-100 bushels per acre in the summer of 1966.³⁸

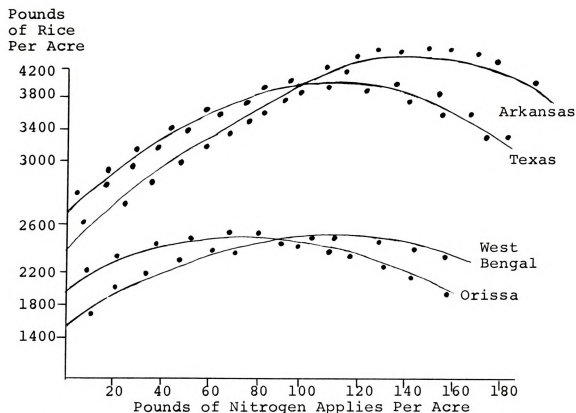
³⁸Hanson, West Pakistan Agricultural Growth.



A comparison of the response of rice to nitrogen in India and the United States by Robert Herdt and J. W. Mellor shows the contrast in the profitability of fertilizer under conditions in which a high-yielding variety of rice has been used and under conditions in which it has not. Figure 3.11 shows fertilizer response functions derived from data from a large number of experiment station trials of various levels of nitrogen application on rice in the states of Texas and Arkansas in the United States and the states of Prisna and West Bengal in India.

The figure shows a positive response to further applications of nitrogen at a much higher level of nitrogen application and rice yields in the United States as compared to India. One single factor accounting for higher yields in the United States is the development of varieties which are high-yielding, adapted to climate, resistant to diseases of the area, and acceptable equally to both farmers and consumers. Assuming 16.7 cents per pound of nitrogen applied in the United States and 22.8 cents per pound in India, the optimal level of application of nitrogen in the United States was three and one-half times as great as in India. The net profit from application of nitrogen was ten times as high in the United States as in India and the rate of return on total cost was on the order of four times as great. The figure shows that with no applied nitrogen, yields in the United States





Source: Robert W. Herdt and John W. Mellor, "The Contrasting Response of Rice to Nitrogen; India and the United States," Journal of Farm Economics, XLV (February, 1964), 150-60.

Figure 3.11. Production Functions for Four States in India and the United States.

are about 50 percent higher than in India, whereas at optimal levels of nitrogen application in each country, yields in the United States are twice as high as in India. Even assuming the same price relationships, in the two countries the differences in the physical input-output relationships alone call for approximately two and one-half times as much nitrogen per acre as in India.

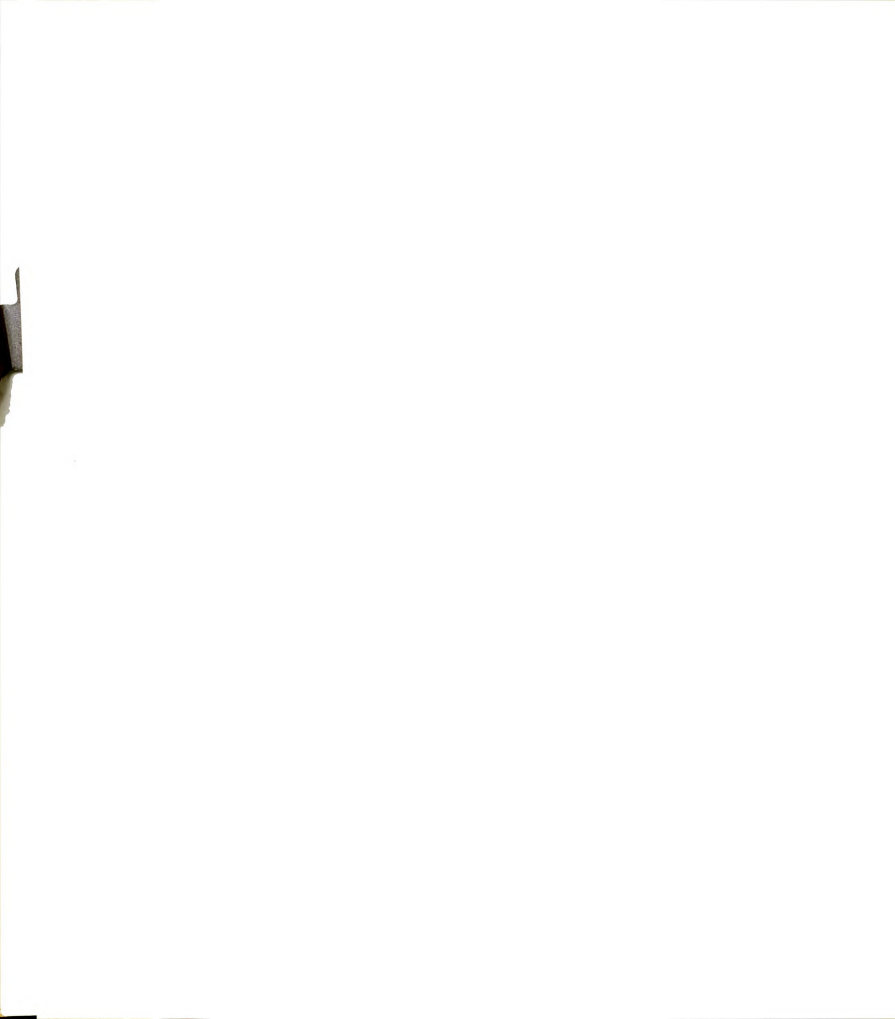


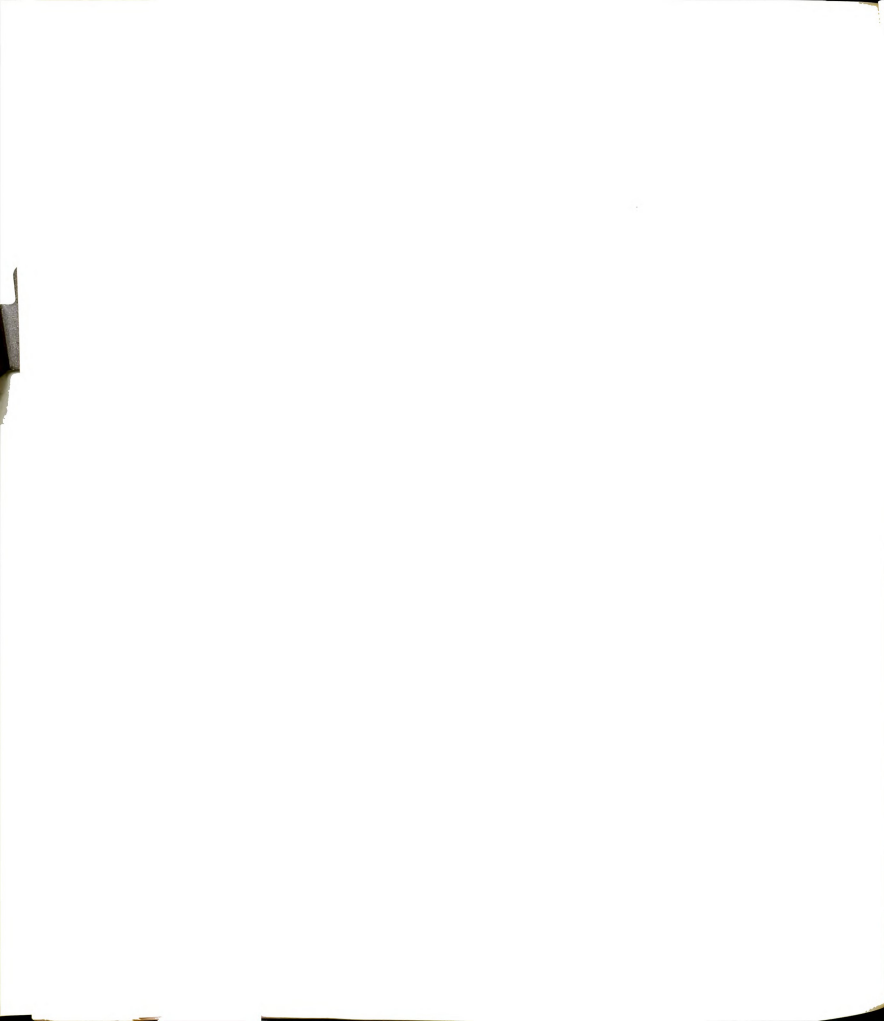
TABLE 3.11. Quantity of Nitrogen Applied, Net Profit, and Rate of Return at Optimal Levels of Nitrogen Application Using Local Prices of All States.

State	Most Profitable Level of Nitrogen	Net Profit Per Acre	Rate of Return on Total Cost
	(pounds)	(dollars)	(percent)
Arkansas	122	62.19	305
Texas	124	44.79	217
Orissa	33	6.48	86
West Bengal	35	4.28	53

Source: Robert W. Herdt and John W. Mellor, "The Contrasting Response of Rice to Nitrogen; India and the United States," Journal of Farm Economics, XLV (February, 1964), 150-60.

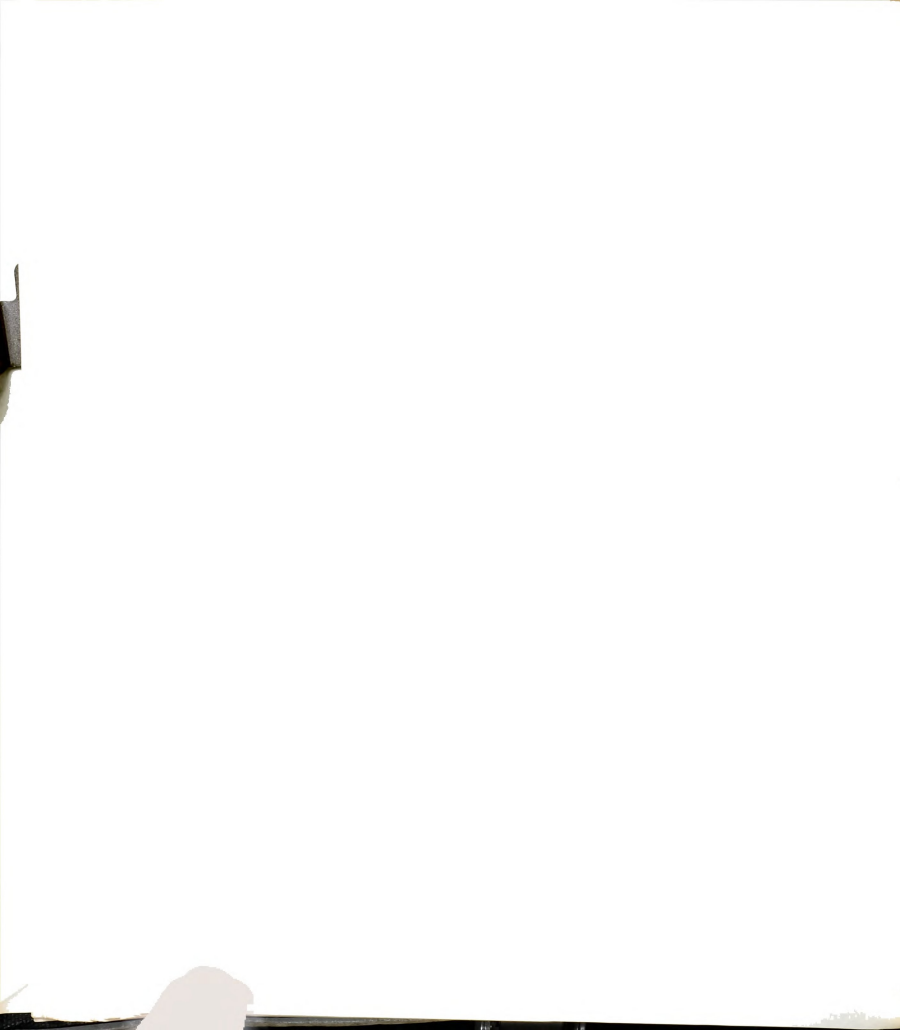
Conclusions

An examination of the system of indigenous fertilizer production indicated that the size of existing fertilizer plants in West Pakistan is too small to permit the utilization of economies of size and scale. In view of the present and anticipated high rate of growth in fertilizer demand, it would be desirable to locate large-capacity fertilizer plants with low per unit cost of production. Their capacity should be so designed that they can be utilized to meet the minimum fertilizer requirement to the extent that the rate of capacity utilization cancels out the economies of size and scale. Growth in



the demand for fertilizer would, however, lead to increased capacity utilization and reduced per unit cost of production over time. In order to reduce the uncertainty and variability in the magnitude of fertilizer imports, they must be scheduled well ahead of time before the next crop sowing season sets in.

An evaluation of the complementary factors influencing the demand for fertilizer showed that a greater supply of irrigation water, increased availability of supervised loans for fertilizer use, and improved terms of lending would considerably increase the possibilities of attaining higher levels of fertilizer use for the farmers. In addition, development of high yielding, fertilizer-responsive crop varieties would lead to improved crop production possibilities and increased relative profitability from fertilizer use under a favorable price environment. A restructuring of the prevailing system of land tenure in West Pakistan is needed to ensure better returns to both the landlord and tenant as well as to promote the level of input use.



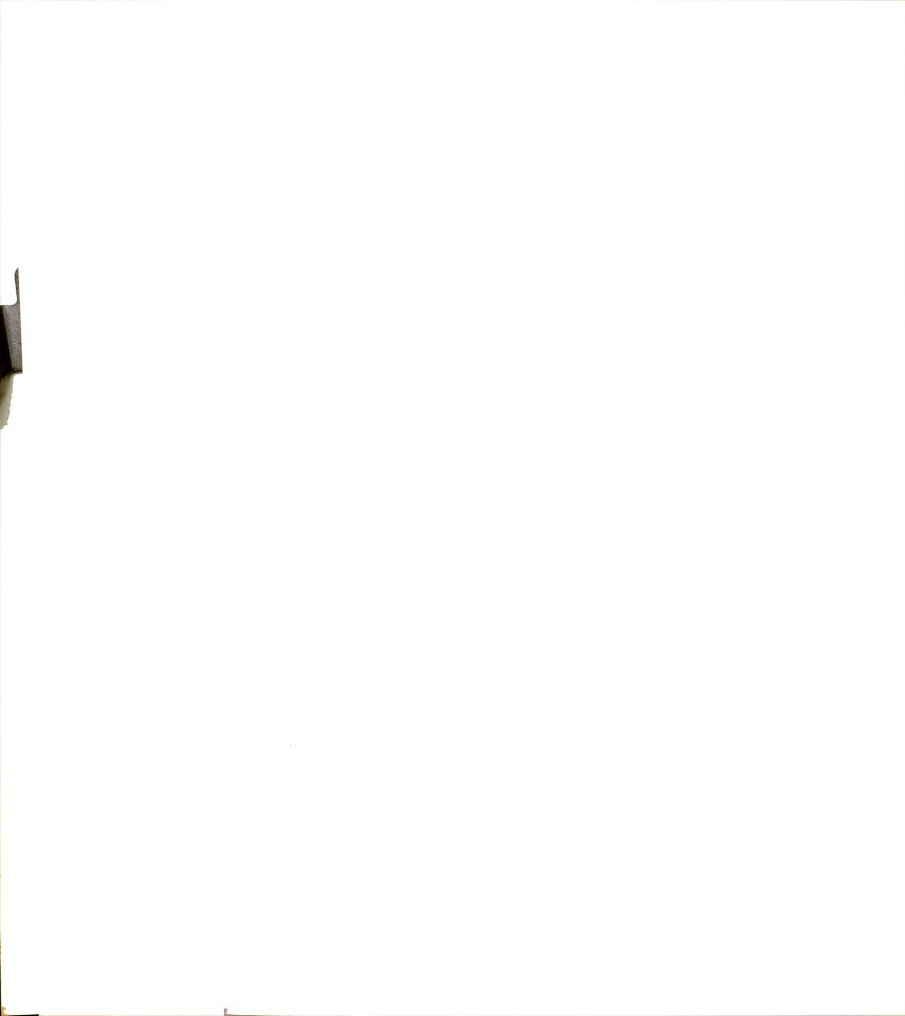
CHAPTER IV

CHANNEL ORGANIZATION AND MARKET STRUCTURE

Introduction

The preceding chapter provided an analysis of the various economic and non-economic variables that tend to affect the market forces of fertilizer supply and demand in West Pakistan. It provided an analytical view of the two market forces as to the manner in which they react or interact with the fertilizer distribution system.

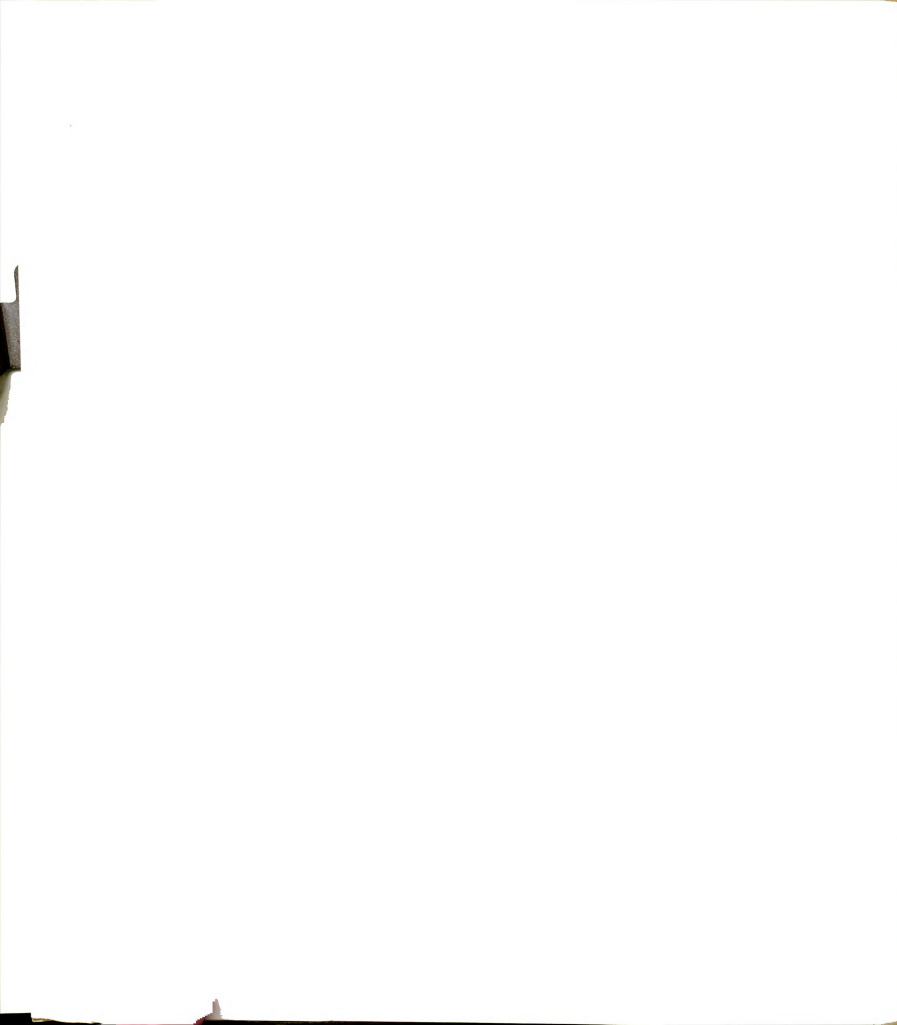
The objectives of this chapter are to examine the process of fertilizer market channel evolution and its organization and to develop a conceptual framework for the analysis of the behavior of the existing fertilizer market channel. It is supposed to trace out the history of fertilizer distribution in West Pakistan and to propose a new organizational setup as an alternative to the existing system of fertilizer distribution in West Pakistan. From a theoretical point of view, the process of fertilizer distribution essentially involves the process of transfer of ownership and creation of time and place utilities through the physical flow of fertilizers from the industrial producer to the farm-consumer end of the



the channel. An analysis of the channel structure would, therefore, involve the character of the link between fertilizer production and consumption as well as tracing out the movement of ownership through the fertilizer channel. A channel of distribution would, thus, be considered to comprise of a set of institutions which perform all the activities utilized to move a product and its title from production to consumption. Thus, the complexity or simplicity of a fertilizer distribution channel in West Pakistan would be partially related to the stage of development of the fertilizer market and partially to the impact of new technical knowledge on market organization. Similarly, the length of delivery time required to transfer a unit of fertilizer from supply point to the demand point will depend upon the extent of dispersion and size of farm-consuming units as well as the centralization of the market, the mode of fertilizer shipment as well as the final form of serviceable fertilizer. A vital link in the analysis of channel structure is, however, a description of the process of fertilizer market channel evolution and its organization.

The Organization of Fertilizer Market Channel

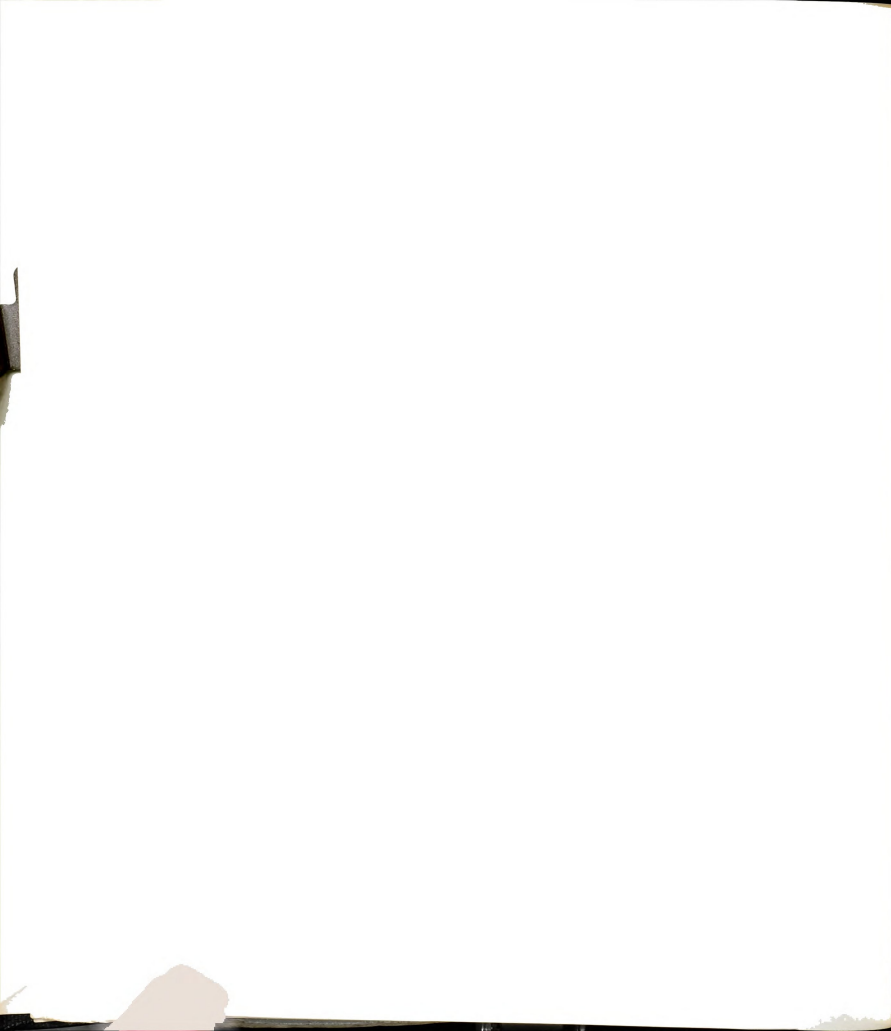
The ownership and control channel for fertilizers has been characterized by a great degree of instability since the inception of fertilizer use in West Pakistan.



Through the process of trial and error, the government of West Pakistan has changed the ownership of agencies and inter-agency distributive shares. A gradual transfer of ownership has taken place from public agencies assuming monopolistic rights for fertilizer distribution to semi-public and private agencies. The organizational changes in the distribution channel have, primarily, taken place to meet the growing demand for fertilizer over a wider and wider geographical area with its attendant problems of storage and transportation. The fertilizer distribution system must, therefore, evolve gradually from organizational simplicity towards complexity, if better service to the farmers is to be provided and fertilizer use is to be further expanded. So to say, the addition of new product lines and increasing service to the farmers is likely to lead to organizational complexity which is the direct consequence of fertilizer market channel evolution.

Under the currently operating centralized marketing system, sellers' relation to the farmers is divergent because of the concentration of fertilizer supply at few production points and wide dispersion of low-income farmer-consumers whose level of per capita fertilizer use is very low, whereas the relationship of farmers to fertilizer suppliers is supposedly convergent. A sequence of fertilizer distribution patterns over the last decade and a half in West Pakistan indicates that the ownership

in the fertilizer distribution system has changed from absolute monopoly by the government to a mix of public and semi-public distribution agencies. The organizational structure of the existing system of fertilizer distribution is illustrated by Figure 4.1. It indicates that the two major sources of fertilizer supply in West Pakistan are the imported fertilizers and indigenous fertilizer production. Whereas indigenous fertilizer production is under the almost complete or partial control of West Pakistan Industrial Development Corporation--a semi-autonomous body--the responsibility for fertilizer imports rests with the West Pakistan Agricultural Development Corporation. In contrast to the continuous and stable supply of domestic fertilizers, fertilizer imports are subject to a considerable level of volatility. An important auxiliary variable that influences the magnitude of fertilizer supplies in a particular year is the availability of foreign aid and allocation of foreign exchange for fertilizer imports. The Economic Affairs Division of the Ministry of Finance in Central Government determines the amount of foreign exchange to be allocated in consultation with the Agricultural Development Corporation. But foreign exchange being the most scarce commodity in Pakistan is subject to variations which may lead to fluctuations in the level and quantity of imported fertilizers that would be available which, in turn, may



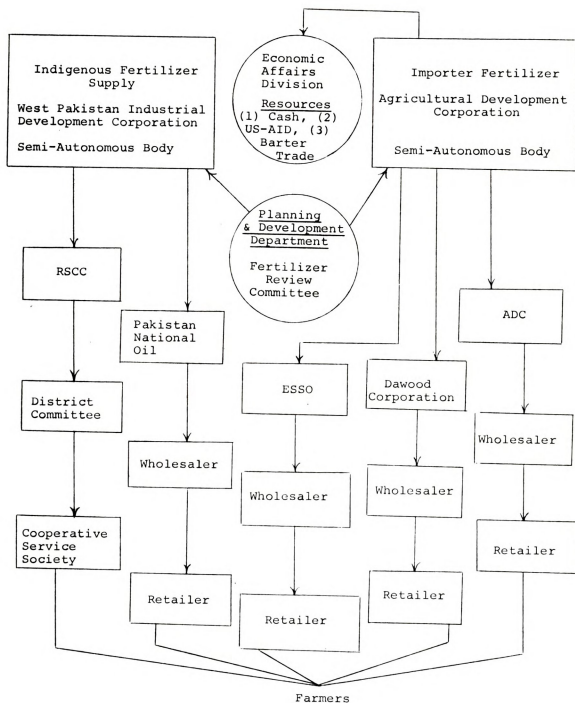
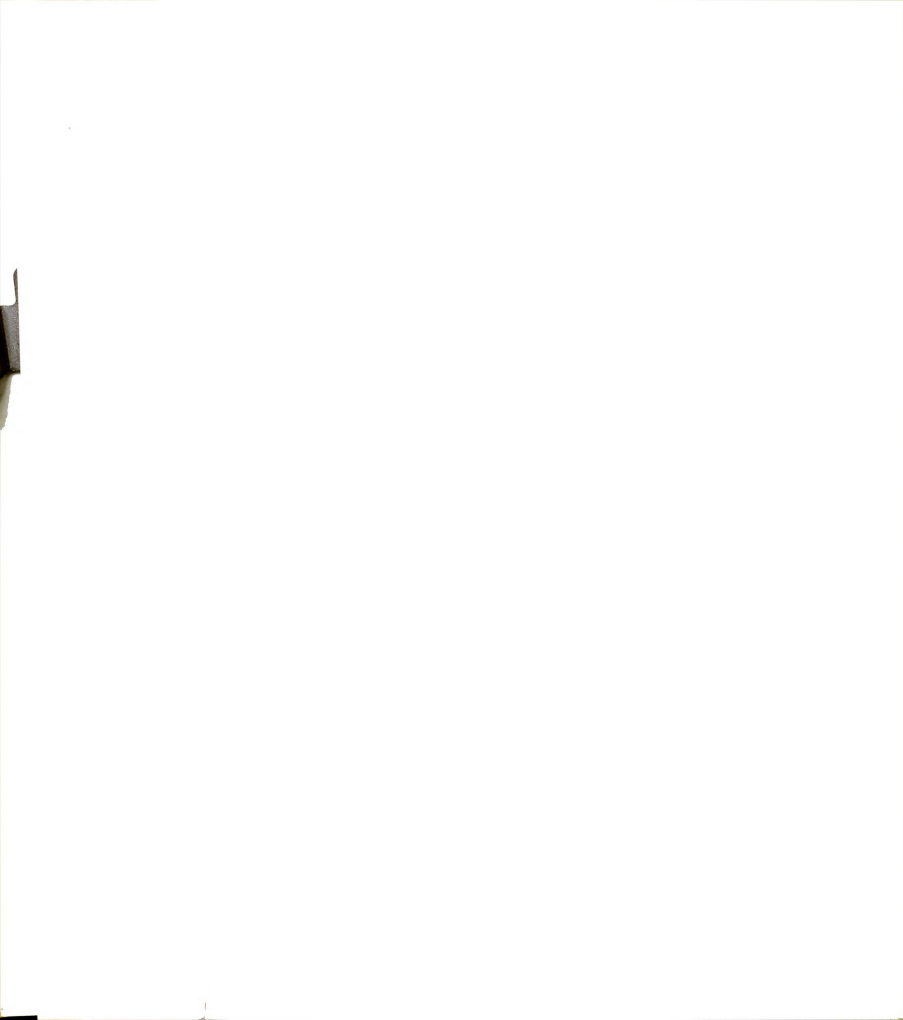


Figure 4.1. Fertilizer Distribution Channel for Ownership and Control in West Pakistan.



introduce shocks to the distribution system. On the other hand, the seasonal nature of the demand for fertilizer is likely to affect the behavior of market participants who may have to build up higher inventories to smooth out the temporal variations in the demand. It is likely to increase the credit requirements of distribution agencies for financing the expansion of storage capacity and meeting operational storage costs. The production plans of farmers are likely to be affected by the non-availability of fertilizers involving significant losses in the form of crop failure or retardation of crops.

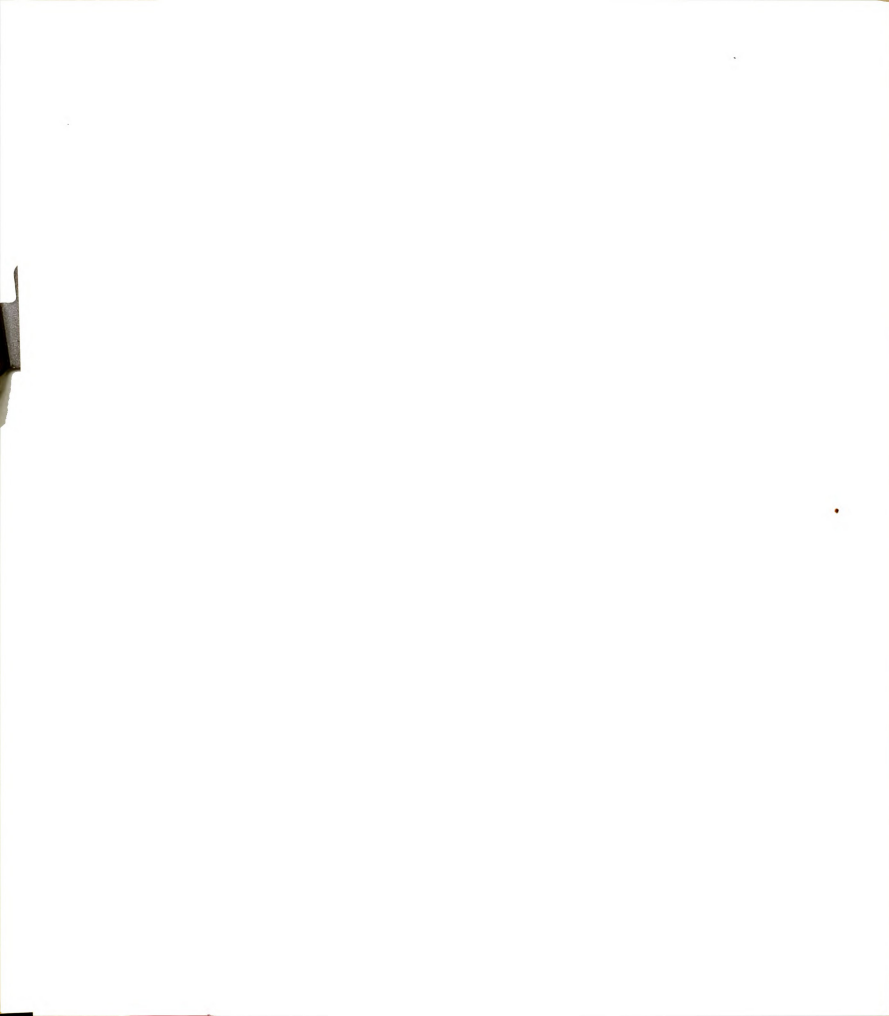
From the organizational point of view, fertilizer market channel is currently organized around five public and semi-public distribution agencies each maintaining its own chain of whole-time as well as part-time wholesalers and retailers whose loyalties tend to switch from time to time. The instability in retailing business arises partly from the satisfying rather than maximizing behavior of market participants and the shifting priorities of distributors with regard to fertilizer quota allocation in case only limited supplies of fertilizer are available. In spite of the fact that fertilizer market channel is composed of various distribution agencies, it does not depict the behavior of an aggregate channel composed of a number of unit channels organized around vertically coordinated fertilizer distribution agencies. Since the



government as the director of economic activity determines the volume of fertilizer that would flow through the market channel during a particular year, it allocates inter-agency fertilizer distributive shares and installs new institutions as well as dissolves old ones. Thus, the pattern of channel configuration is more or less determined by the government rather than by the market competition. Apart from being the allocator of resources, the government plays the role of a regulator of market behavior, limits the extent of market competition by enforcing a flat pricing system and fixed marketing margins for fertilizer. The sources of fertilizer supply tend to create a greater relative uncertainty for those distribution agencies which depend upon fertilizer imports than those which rely on indigenous fertilizer. In addition, while there exists a vertical flow of fertilizers through the fertilizer market channel, the currently operating organizational structure of the market channel does not provide for the flow of fertilizers from one distribution agency to the other, in case excesses or deficits of fertilizer occur among the distributing agencies beyond the annually fixed quota of fertilizer.

Analysis of the Fertilizer Market Channel

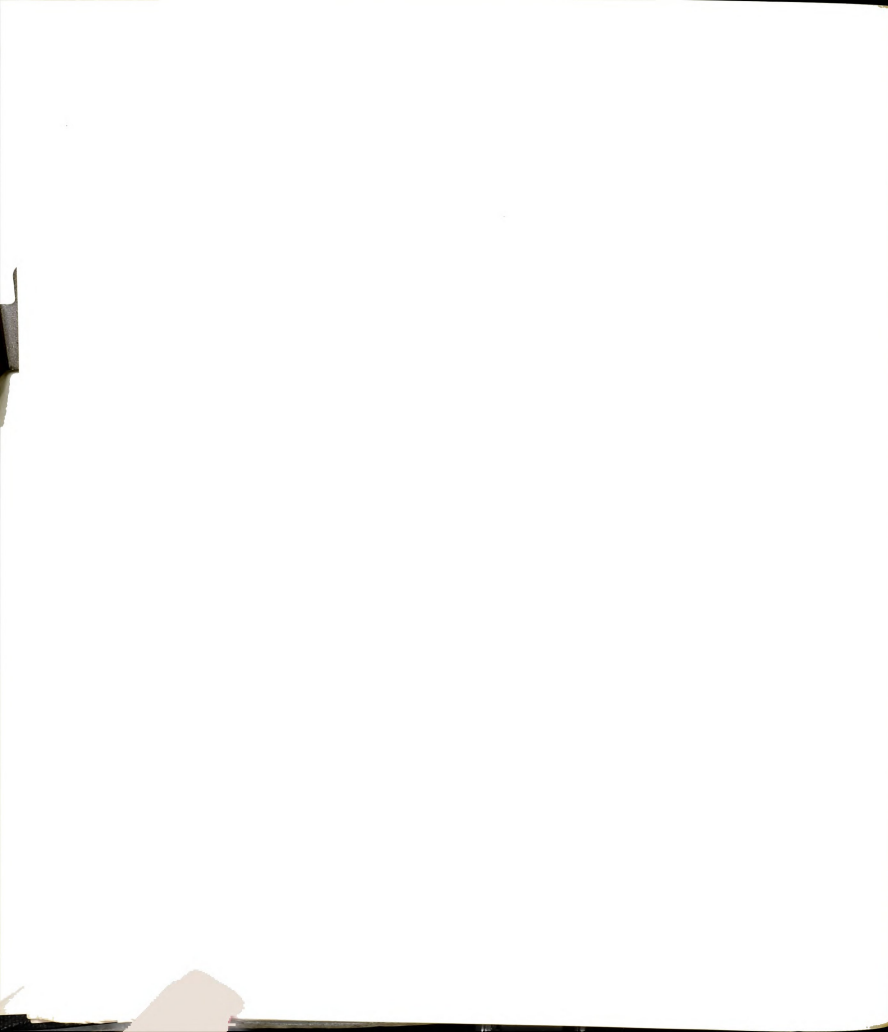
The concept of marketing in its widest sense is any activity which actualizes the potential relationship through exchange between the makers and users of economic



goods and services. An input marketing channel consisting of a vertical sequence of trading concerns is traditionally assumed to bridge the gap between the producer and the farmer-consumer. Thus, the vertical segments involving exchange mechanisms at various levels of transaction from the producer to the retailer and farm-buyer may well be classified into three economic markets.

1. First, the exchange mechanism between the manufacturers as a seller and wholesaler as a buyer.
2. A second market is the exchange mechanism between the wholesaler as a seller and retailer as a buyer.
3. Third, the exchange mechanism between the retailer as a seller and the farmer as a buyer.

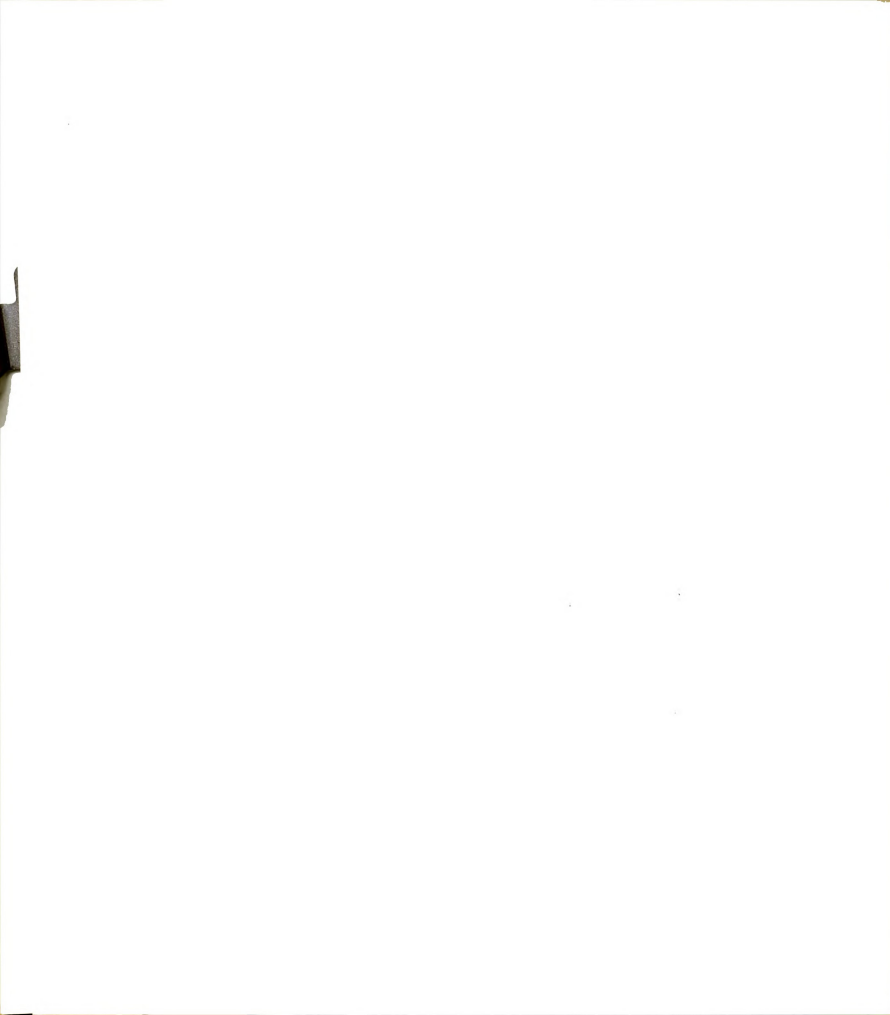
Due to the imposition of a comprehensive control on fertilizer prices by the government through a system of allotment and fertilizer quota allocation, the exchange activity that takes place among these economic markets operates within the defined limits of price control. As a measure of fertilizer policy, the imported as well as indigenously produced fertilizers are considered the property of provincial government and titles to ownership are transferred to the various semi-public and private distributing agencies at f.o.b. ex-factory prices for indigenous and c.i.f. Karachi for imported fertilizers.



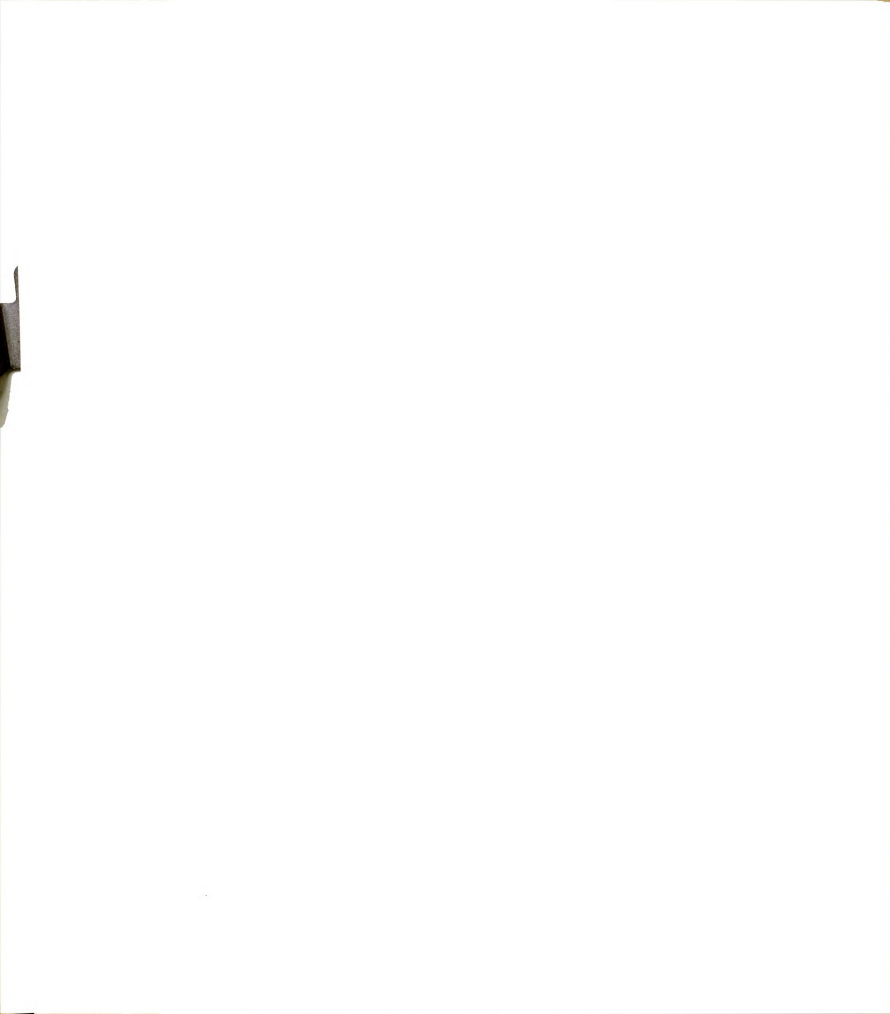
Government finances the cost of fertilizer movement from the supply point to the places of delivery to the farmers, thereby maintaining fixed marketing margins for the distribution agencies, wholesalers, and retailers as well as fixed resale prices throughout West Pakistan. The broad policies of the distribution agencies are subject to stipulations from the government such as:

1. Fertilizers are to be distributed to the growers of crops in keeping with the allocations made for each individual distributing agency.
2. Black marketing of fertilizer above the officially fixed resale price and overcharging of marketing margins by the market functionaries is legally not allowed.
3. Deliberate withholding or adulteration of fertilizer stocks is prohibited.

Insofar as the operation of economic markets at various levels of the fertilizer channel is concerned, at the wholesale level the exchange mechanism takes place between the fertilizer producers and the various fertilizer distributing agencies. Fertilizers are allocated to the private distributors on the basis of the broad policy of the government, the plan objectives, and past performance of the fertilizer distributing agencies. Since fertilizers are required to be distributed on fixed

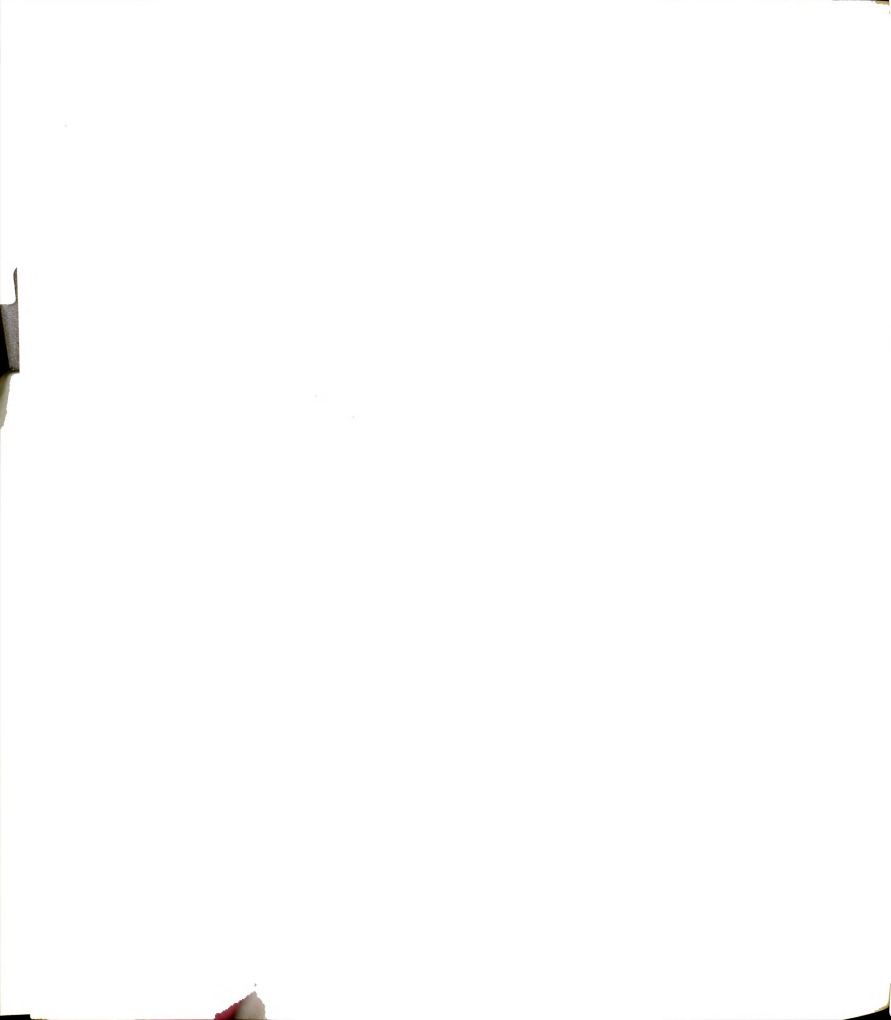


terms of sale and pricing practices, the problems of bargaining arise only relative to the volume of fertilizer to be allocated to a particular agency. In general, the amount of fertilizer that a particular agency gets is based on its "capacity to distribute," irrespective of its relative market position and the ability to maximize its revenues. Because of the spatial dispersion in the location of fertilizer plants and large variance in the size of plants horizontal competition among fertilizer producers is almost nonexistent. In contrast to the retail price, the f.o.b. mill price of fertilizer is, therefore, dictated by the production and cost schedules of the firms, their market power, and government price regulations. On the side of wholesale fertilizer distributing agencies, horizontal competition tends to exist in the expansion of their geographical coverage and entry into each other's territorial market shares. The possibilities of vertical conflict under the existing system of fixation of profit margins of wholesalers and retailers in monetary terms are greater because of the squeezing marketing margins and declining capacity of wholesalers and retailers to sell fertilizer at the officially fixed retail price with a general rise in the price level. Under the current system of distribution WPADC allows for four months free credit to private distributors from the date fertilizer is delivered to them at the Karachi



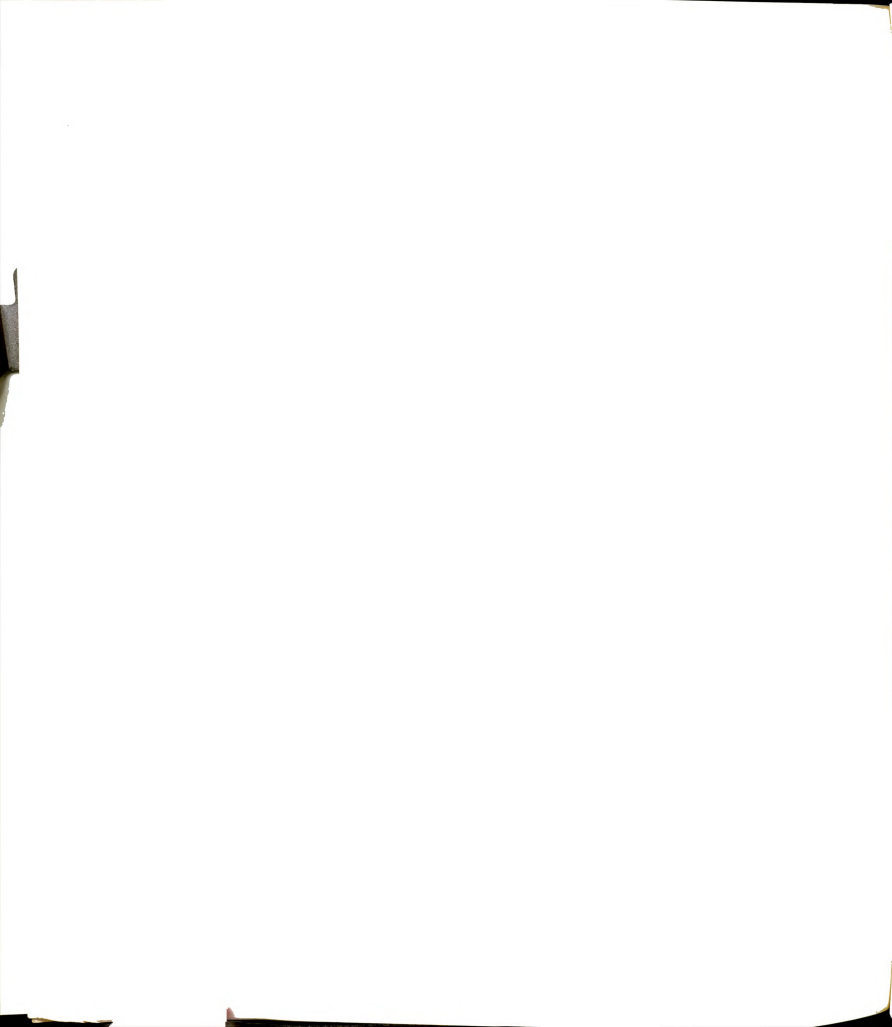
port. The distributors, in turn, rely upon retail agents for their cash requirements while keeping a small amount of revolving fund. The existing tendency of wholesale distributors does not encourage them to make investments for the improvement of fertilizer distribution system due to the fact that limited marketing margins are only adequate enough to recover the distributor's costs and to maintain the existing facilities while yielding barely enough returns to remain in business at the current level.

The operation of economic market at the second vertical segment of the fertilizer transactions is determined by the exchange mechanism between wholesale distributors and retailers which operates on a tacit agreement based on terms of sale and fair business practices. Fertilizer stocks are directly shipped to whole-time as well as part-time dealers known as commission agents operating in various mandi towns all over West Pakistan. The local commodity markets are usually found at tehsil level and the commission agents who serve as brokers cum wholesalers for the sale of wheat, rice, cotton, and other agricultural raw materials also deal in fertilizers serving the entire region that a mandi encompasses. The local commodity markets that serve as a focal point for the collection of farm commodities and distribution of fertilizers are connected with villages through a network of low-capacity muddy roads. The means of transport are very primitive and fertilizer must be carried on ox-cart,



animal backs, and also on human backs. This leads to a considerable market imperfection due to the bottlenecks in the movement of fertilizer from one mandi to the other. As a matter of distribution policy, fertilizer dealers are required to put up a cash deposit with the distributor in varying amounts depending on the wholesaler with whom they are dealing and to pay cash for railcars of fertilizer prior to their obtaining possession. This limits the quantity of material that an agent can stock at a time and also draws heavily upon the low capital position of retailers who must sell fertilizers for cash if he is to remain liquid. The exchange mechanism operates in a considerably imperfect environment. Lack of perfect knowledge, geographical dispersion of fertilizer retailers, and strict terms of sale between the wholesalers and retailers continue to make the market imperfect.

The exchange mechanism between the retailers and farm-buyers is non-competitive insofar as the retail prices are publicly fixed. In some cases, retailers take advantage of their position as a spatial monopolist and indulge in overcharging. The individual size of the retailer is small, because of the atomistic structure of the market at the farm level and low level of fertilizer use per acre. Due to the existence of non-competitive environment farm-buyers get less in terms of marketing services like soil testing facilities and mixed fertilizers required by soil type. There is usually a limited

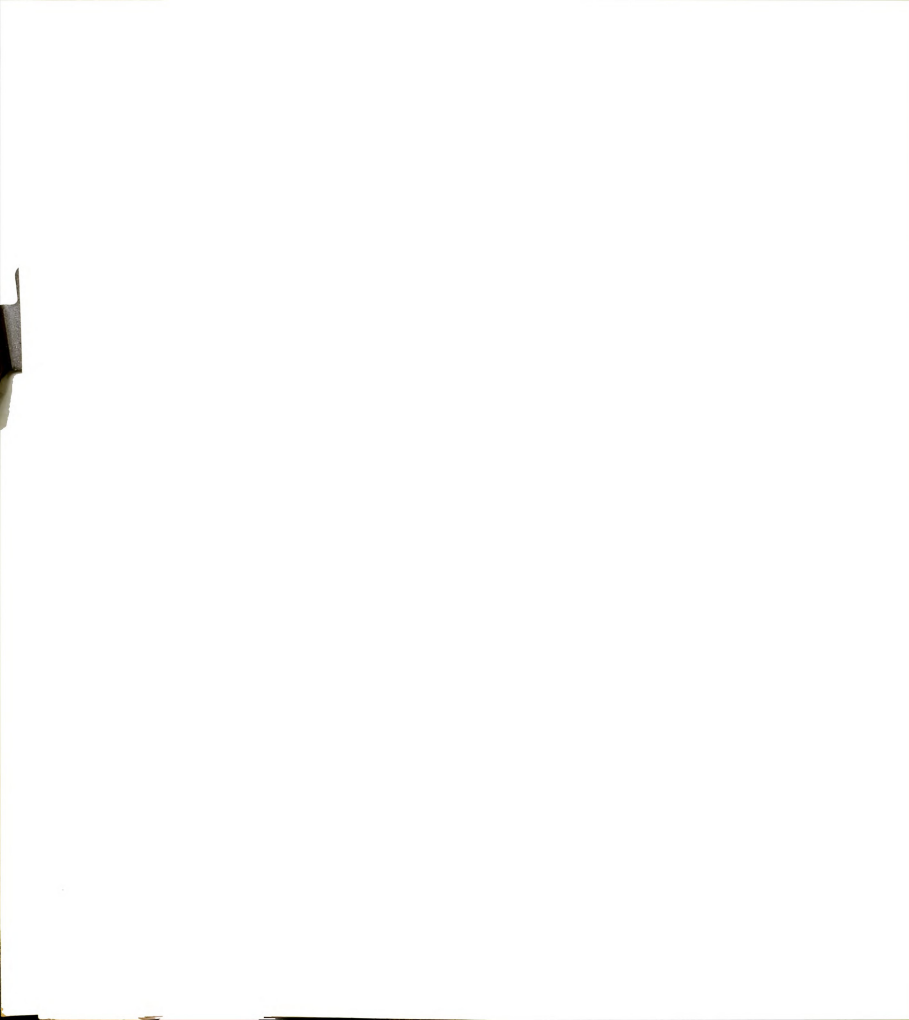


product choice, with almost no product differentiation and grading of fertilizers. Since there exists no such marketing service as the home delivery of fertilizers, the farmer has to bear the high cost of local delivery in terms of time and money. Thus, in spite of a fertilizer subsidy, and fixed retail price, the real cost per bag of fertilizer to the farmer tends to remain high.

Since a fundamental goal of the fertilizer distribution system is to attain efficiency, it may be defined as the maximization of output-input ratio. In other words, fertilizer marketing efficiency is the minimum ratio of price spread between the ex-factory price of fertilizer and retail price at the farm level that can be attained; in addition to the extent of marketing services provided in terms of faster delivery, product choice, mixed fertilizers, and market to farm transportation facilities. An increase in marketing may, therefore, lead to lower per unit costs of input via market expansion of fertilizer through greater consumer convenience.

Criteria for Channel Performance

The concept of channel performance for the evaluation of fertilizer market channel under review, is essentially normative and is concerned with the overall output of utility from the system itself. Channel performance is a dynamic concept insofar as it permits the goals of the society to shift over time. Thus, in a

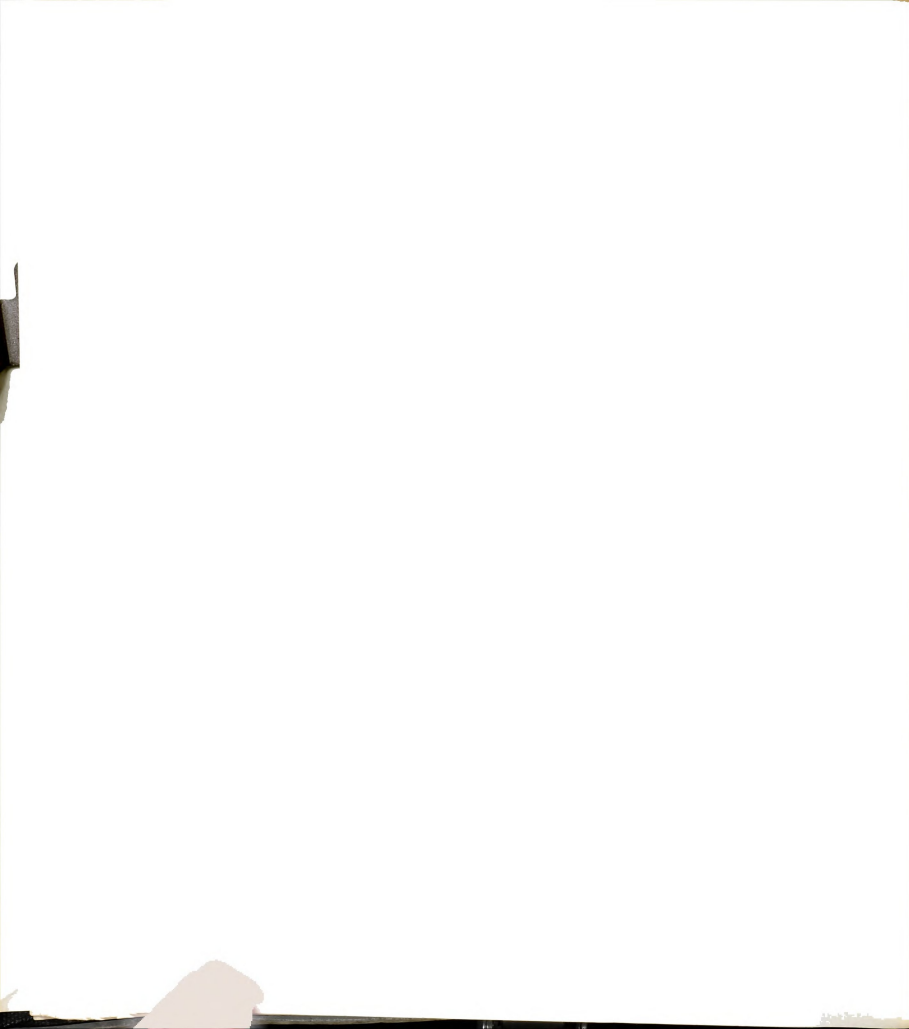


dynamic society involving changing values, a normative evaluation of the channel performance may be valid for only a particular period of time. In general, a set of criteria can be laid out for the desired directions in which fertilizer market channel evolution must take place, such as: (1) progressiveness, (2) channel efficiency, and (3) channel coordination.

Progressiveness

The system of fertilizer channel organization would be termed as progressive if it is flexible enough to adjust to changing market conditions. It must be able to absorb new technical knowledge and generate organizational and product innovations. In order to keep abreast with market expansion, farmers' needs and general social welfare, it must possess organizational flexibility and adequately trained management personnel to give direction to the fertilizer distribution policies and to maintain economic viability. The existing channel organization which consists of public and semi-public distribution agencies does not have the economic incentive, profit motivation, and resources to engage in technological innovation and marketing research. This may be due to the:

1. Smaller size of distribution agencies and lack of availability of basic research



concerning the behavior of input markets in underdeveloped countries.

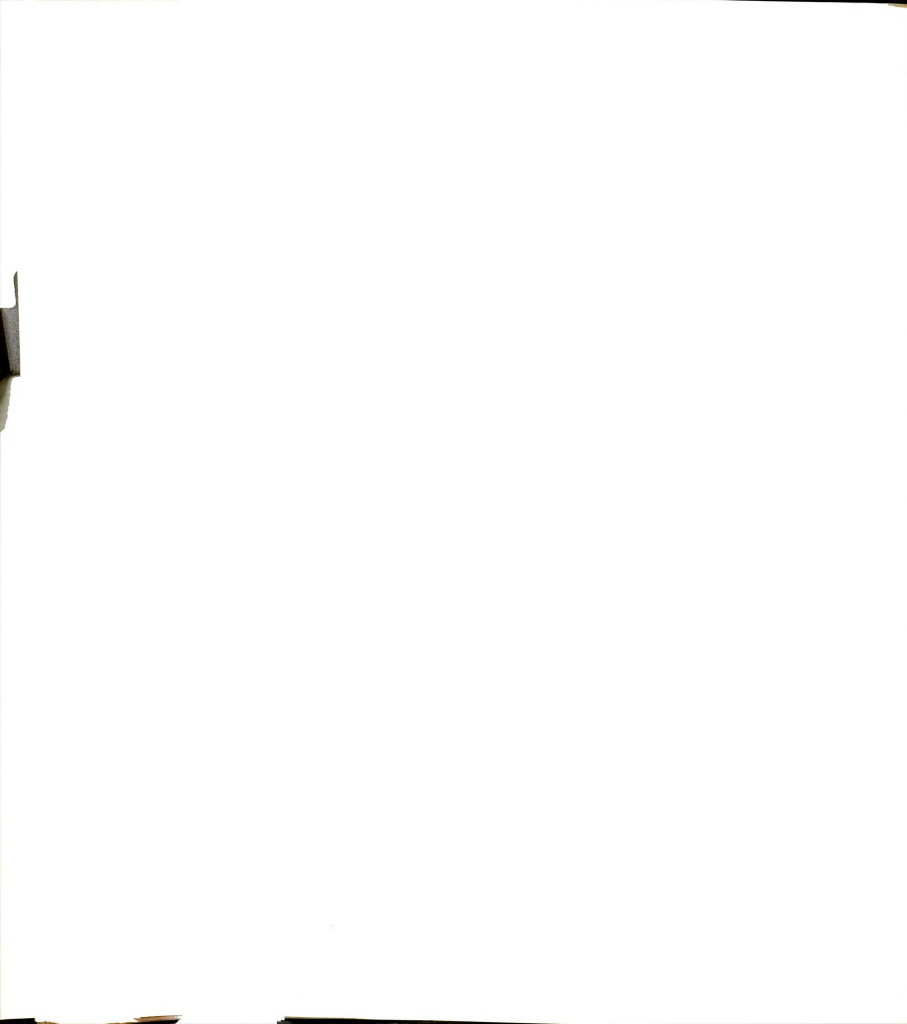
2. Lack of adequately trained personnel.
3. Lack of firms' adequate internal resources which may be invested for internal expansion of the firm.
4. Lack of public or private institutions to provide credit to the fertilizer distributing agencies for the pursuance of this research.

It may, therefore, be recommended that the government should help promote the conduct of such research through close cooperation of universities, research institutions, and fertilizer distributing agencies. The progressiveness of market channel is closely related to the channel efficiency insofar as the new technical change aims at maximizing the output-input ratio.

Channel Efficiency

How well the fertilizer distribution system of West Pakistan is organized depends to a large extent upon the operational efficiency of the fertilizer market channel. The specific performance goals concerning channel efficiency may thus be formulated around the following conditions.

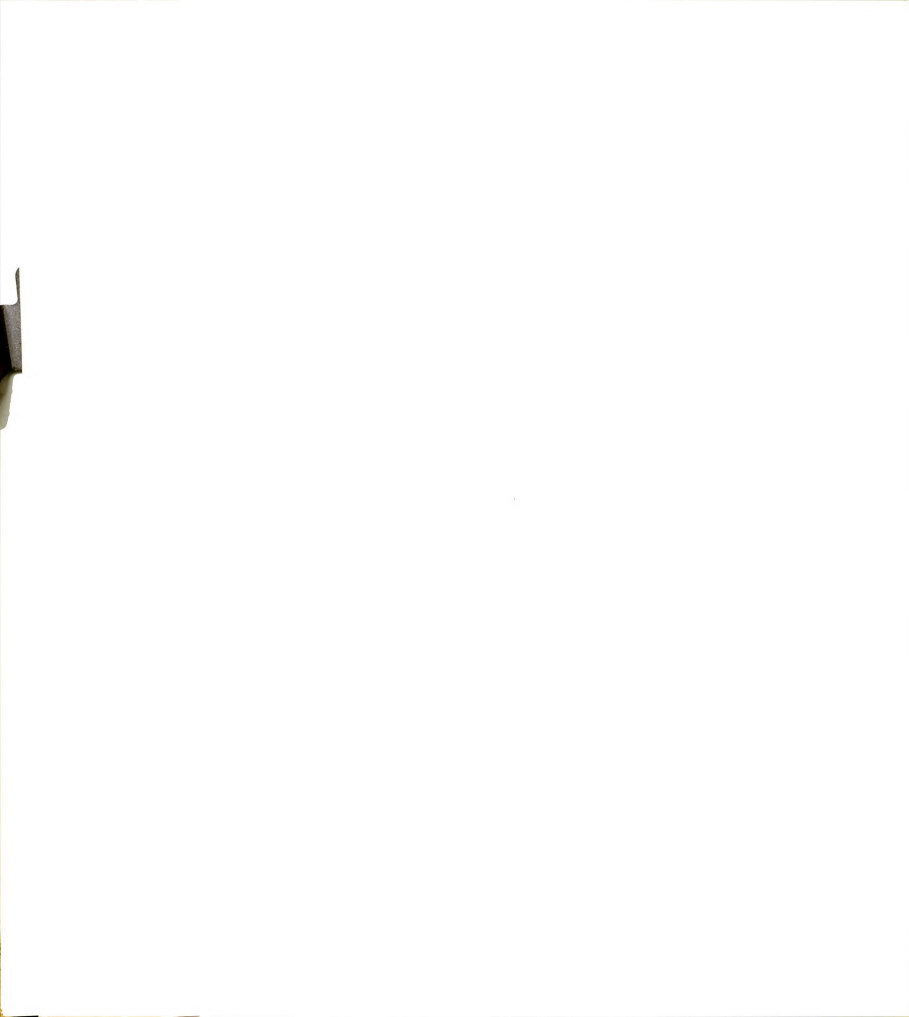
1. Are production and channel costs being reduced and if so how are the benefits distributed and used to further economic growth



objectives with, of course, the exception of short-run increases in costs in order to obtain long-run profits?

2. Does the existing system of channel organization provide for dynamic interaction between fertilizer producers and farmers in order to create and fulfill demands for new and better fertilizer products?
3. Does the fertilizer market channel function so as to transmit effective farmer demand to fertilizer producers and facilitate production achievements?

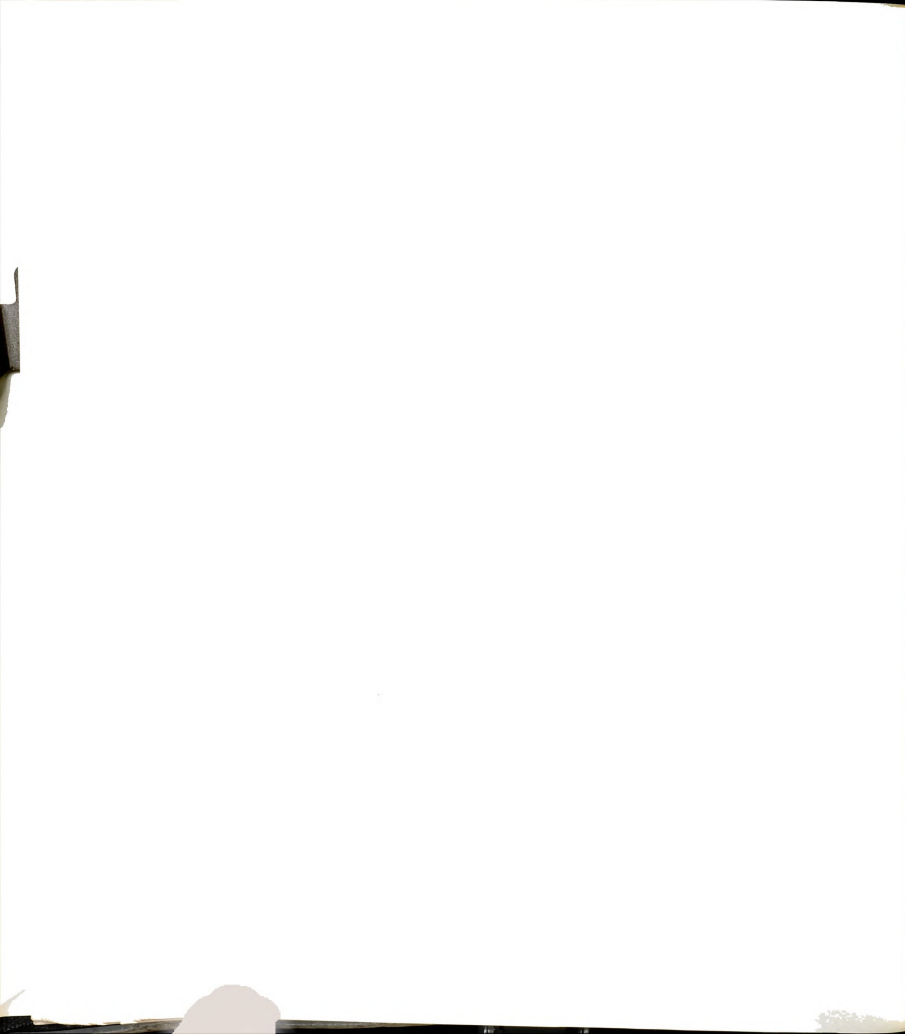
This criterion aims at the maximization of output-input ratio by providing maximum marketing services at the least cost and streamlining the process of fertilizer distribution by eliminating inefficiencies in pricing, volume handling, and management organization. Its main objective is to evaluate the extent of value added by the marketing process to the product handled through the fertilizer channel. Since the transfer of goods and services from fertilizer producers to farmers involves the process of creation of time and place utilities, the marketing channel would be efficient if the product handled undergoes major transformations in terms of processing, packaging, grading, and standardization at the least possible cost. The existing system of channel organization may be considered to be the least productive



insofar as the stages of productive activity and product transformation are concerned. The fertilizer market is so small and the number of distributing agencies so large that none of them enjoys a larger market share in order to attain the required level of channel efficiency. In short, a reorganization of the fertilizer marketing channel involving vertically integrated and larger distribution firms would, however, lead to the internalization of external economies of various marketing processes like grading and bagging of bulk fertilizer, etc.

Channel Coordination

Channel coordination is the mechanism whereby fertilizer producers and farmers are supposed to interact to exchange relevant market information, to establish conditions of exchange, and to accomplish the physical transfer of fertilizer. The process of channel coordination may, however, be accomplished through a system of flexible prices coordinating an immense number of independent actions by the freer adjustment of supply and demand. The extent to which channel coordination is effective in the attainment of indicated objectives may well be assessed from the costs of coordination and marketing progressiveness, product variety, and quality. Improvements in the channel performance may also be exacted through external channel coordination which will help reduce the overall level of channel risk and



uncertainty through improved storage and market information and price stabilization programs.

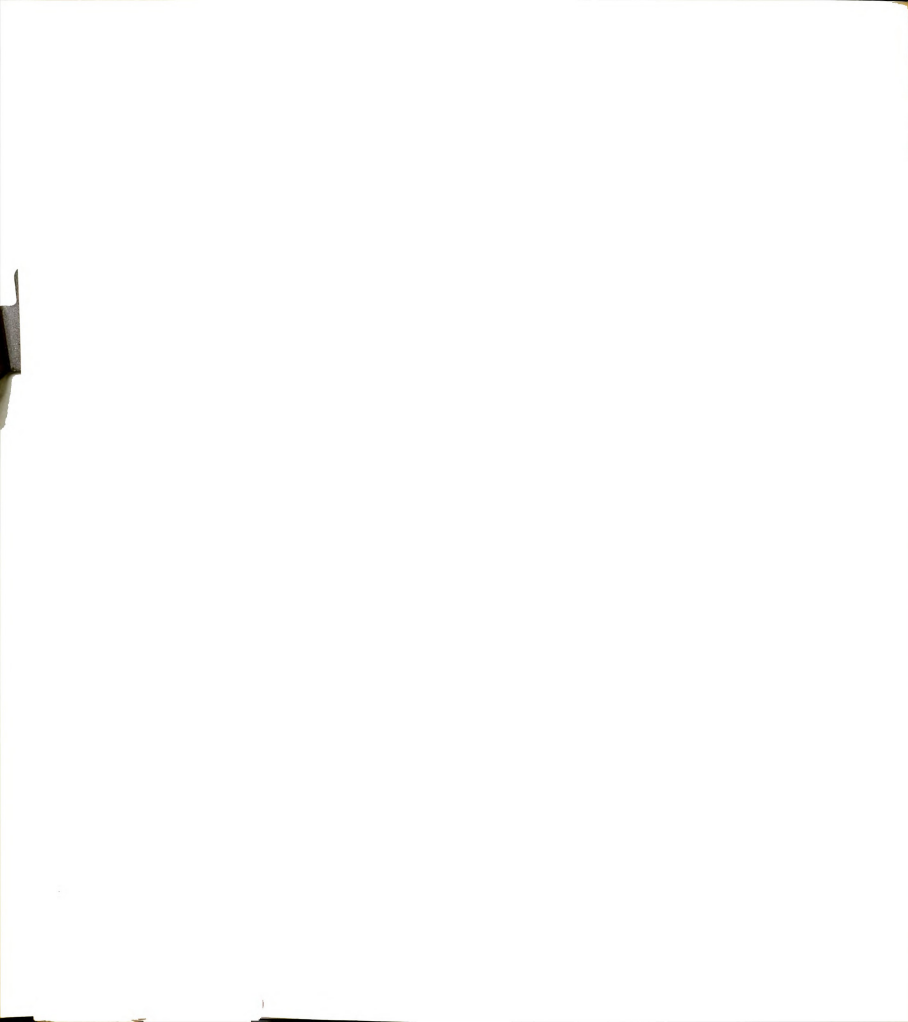
Impact of Fertilizer Imports on
the Distribution System

The problem of making fertilizers available at the required time and place constitutes a major challenge to the fertilizer distribution system of West Pakistan. Irregularity and uncertainty in the availability of imported fertilizer, the most volatile component of the aggregate fertilizer supply, can give shocks to the distribution system resulting in a great variability of prices, frustration of farmers' plans regarding cultivation with a considerable impact on the level of farm income. It is, however, likely to give a new direction to the fertilizer market which may function spasmodically or exhibit such an unstable behavior as to be constantly on the verge of explosion and discontinuance. A stable behavior pattern of the fertilizer market could, however, be reflected only in regular and well-timed supply of fertilizers through a smoothly functioning distribution system.

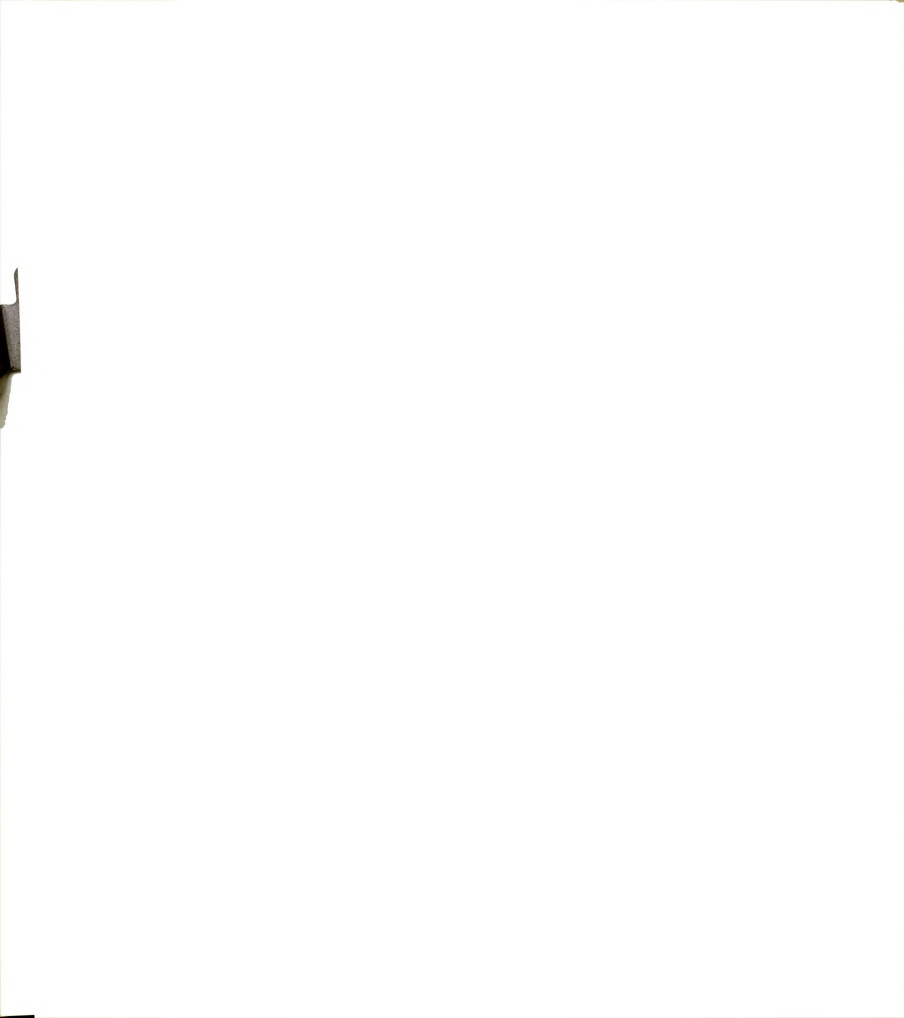
A proper timing of fertilizer imports would require an advance assessment of the fertilizer needs during a particular year, the source of fertilizer imports and the required foreign exchange. Under the principle of postponement-speculation, it will be

desirable to build up inventories at various levels of distribution system in order to effect a faster delivery and to overcome the delays arising from the inefficiency of the transportation system and paucity of access roads from railheads to villages. The capital as well as operating costs of maintaining a desirable level of inventory to overcome temporal delay may be much less than the private and social costs arising from the non-availability of fertilizer.

Since there exists a pseudo-complementarity between temporal and spatial availability of fertilizer, the costs of late fertilizer delivery arising from an inefficient railway system are likely to more than offset the gains arising from greater availability of fertilizers. Under the existing system, longer delivery time is required for spatial distribution of fertilizer due to the fact that a limited railway handling capacity does not permit larger fertilizer shipments and the turn-around period per rail-car is supposed to be long because of the preference of passenger trains over goods trains. On the contrary, trucking costs show a progressive rise with the increase in ton-mileage and cannot effectively compete with the per unit handling costs of railway beyond fifty miles. Thus the current need is either to build up an adequate inventory system or to regulate the fluctuating supplies of imported fertilizers in order to channel the stock of



fertilizers available through a fixed railway handling capacity. Alternatively, worthwhile solutions will have to be found for the improvement of the efficiency of railway handling capacity which must be flexible enough for accommodating a variable volume of imported fertilizers. The problem of handling and affecting a timely delivery of imported fertilizers assumes further complications because of the high up-country costs of fertilizer shipment from the port of Karachi which tend to rise proportionately with the increase in distance. On the other hand, indigenous fertilizer production points have both wide dispersion and locational advantage insofar as they enjoy lower per unit costs of fertilizer transportation to the points of consumption as compared to imported fertilizers. Since the port of Karachi remains completely isolated from the major fertilizer consuming regions of West Pakistan, the problems of channelling the flow of fertilizers to the remote regions of Peshawar division through an already overburdened system of transportation take on extra complexity. The goods trains are subject to numerous stoppages and unnecessary delays involving an average turnaround period of twenty days including losses in terms of pilferage, late delivery, and backhauling costs. The cost per ton-mile for the up-country movement of imported fertilizer from the port of Karachi tends to be high as compared to the indigenous fertilizers due to the backhauling



costs that arise from a higher ratio of imported to exportable tonnage. On the contrary, an internal system of fertilizer distribution is likely to avoid the costs of backhauling insofar as the costs of inter- and intra-regional commodity movement cancel out.

A theoretical illustration of the relationship between delivery time and average costs to the marketing system is presented in Figure 4.2. It is assumed, however, that slower delivery permits larger stocks at intermediate points, whereas fast delivery of direct shipments from fertilizer producers to farmers is likely to be very expensive due to the fact that the amount of risk and channel costs for this mode of operation are very high.

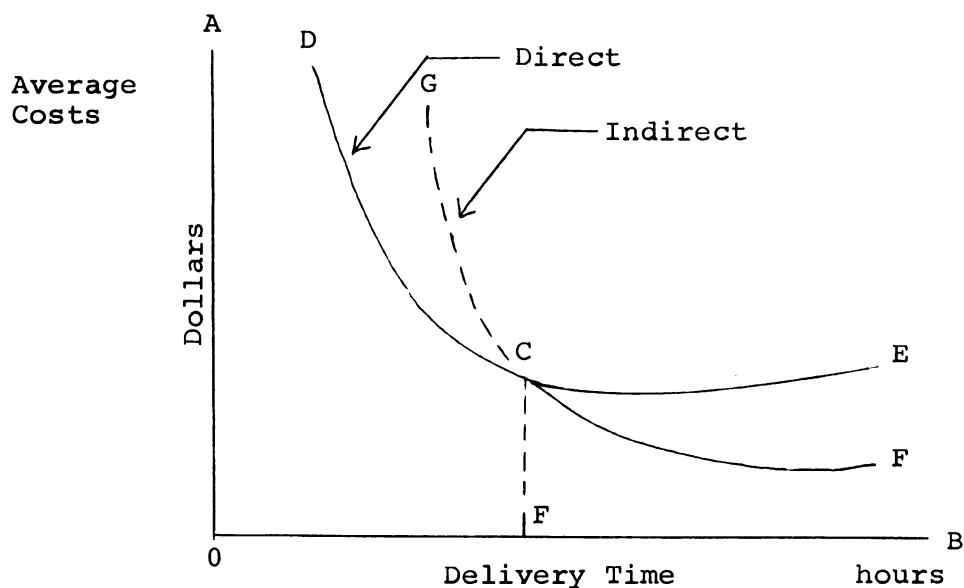
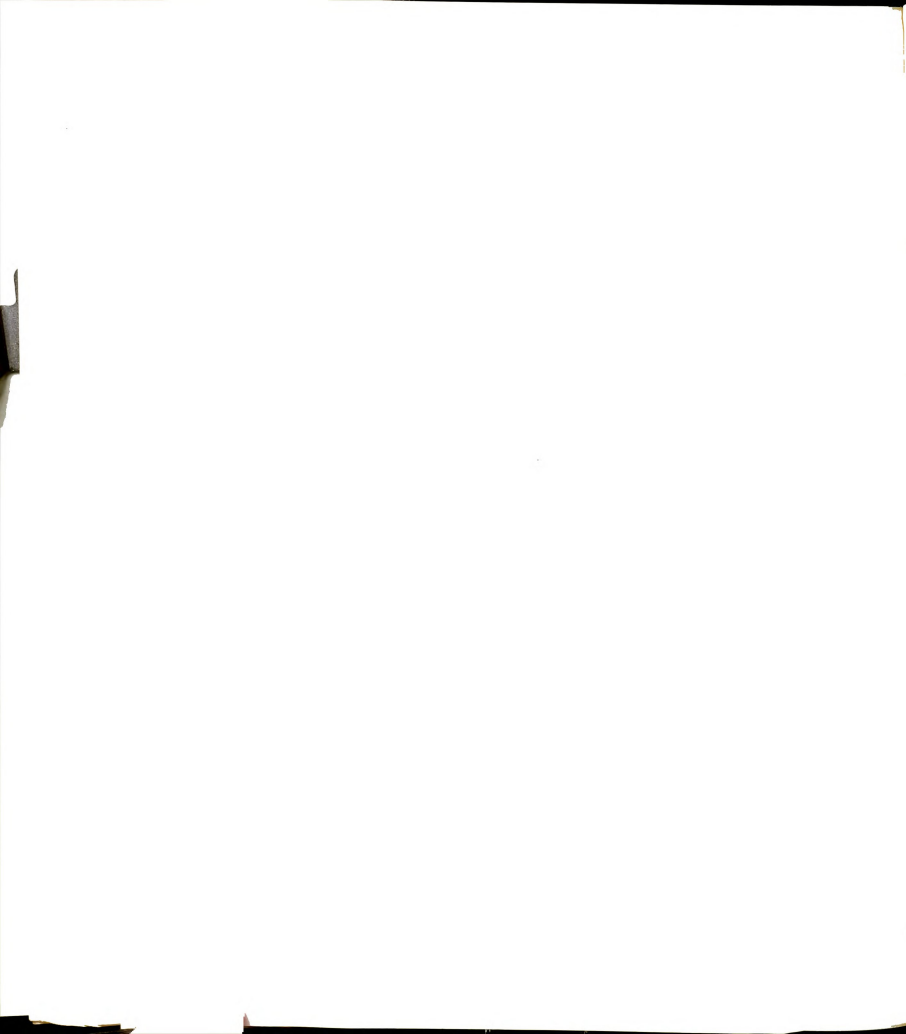


Figure 4.2. Direct and Indirect Methods of Fertilizer Delivery.



In Figure 4.2, the costs of fertilizer delivery include the transportation, storage, and handling costs which are represented in dollars on the vertical axis. The locus of costs incurred by the method of direct fertilizer shipment are represented by DCE which is negatively declining and shows decreasing costs for an increasing delivery time due to the fact that slower and less expensive means of transport could be substituted to move goods over a longer period of time. The curve GCI indicates an inverse relationship between the time of delivery and average costs to the marketing system for the indirect method of fertilizer delivery. The point of intersection C indicates that a fertilizer supplier would prefer the indirect mode of shipment at less per unit cost for a delivery time which is longer than OF. A speculative inventory can, however, be located at point C where the costs of keeping an inventory are far less than the net savings that may accrue to both the buyer and seller from postponements. Thus an optimum mode of shipment would be that which aims at minimizing the average costs to the marketing system keeping in view a fixed delivery time.

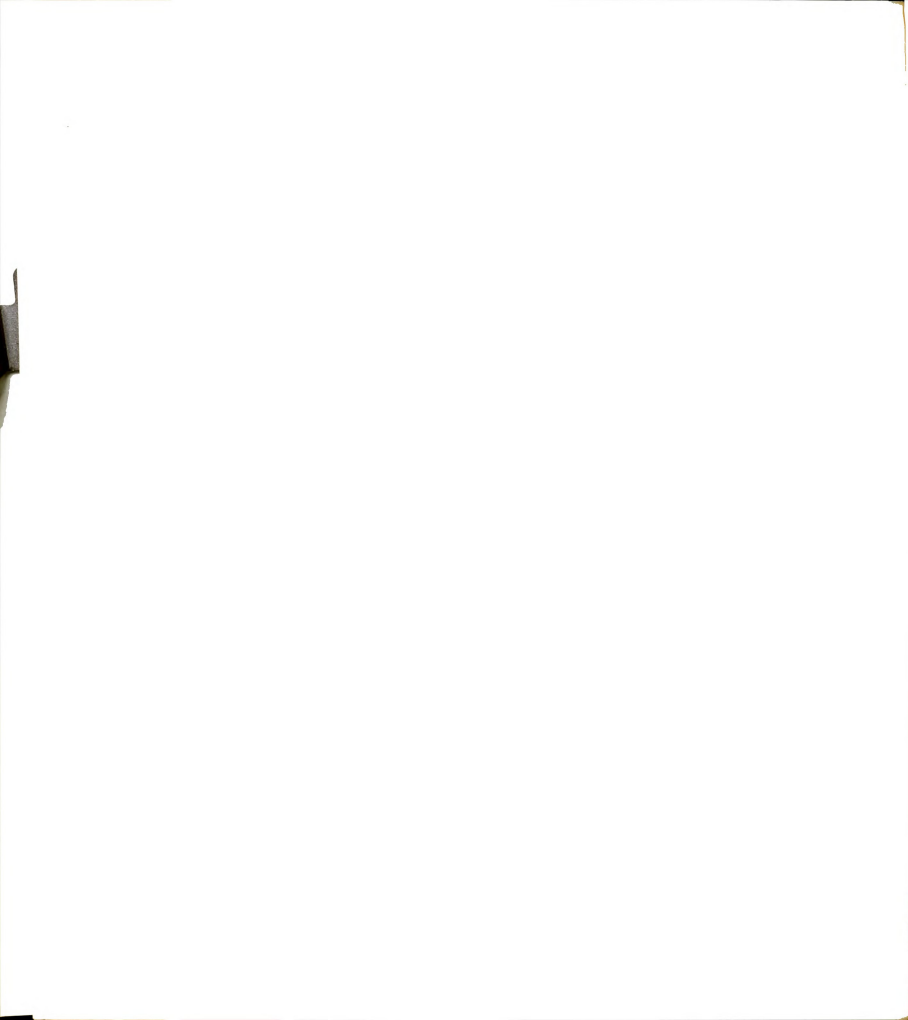
Fertilizer Distribution System of West Pakistan in Retrospect

An examination of the history of fertilizer distribution in West Pakistan indicates that fertilizer distribution channel has undergone drastic transformation



since the inception of fertilizer use. Whereas the sources of fertilizer supply have shifted from entire dependence on imports in 1952-53 to a position of partial reliance on indigenous production, the fertilizer distribution structure has experienced the dissolution of old inadequate unit market channel to be replaced by a new multi-unit fertilizer market channel. The process of this transformation in the fertilizer channel configuration will be outlined later. The major reasons for this change seem to be the rapid rate of growth in the demand for fertilizer and the instituting of specialized in place of non-specialized distributing agencies in order to cope with the growing marketing radius of fertilizers and its attendant problems of warehousing and transportation. These transformations may also be attributed to the steady rise of per acre fertilizer application rates and the higher annual rate of turn-over of fertilizer.

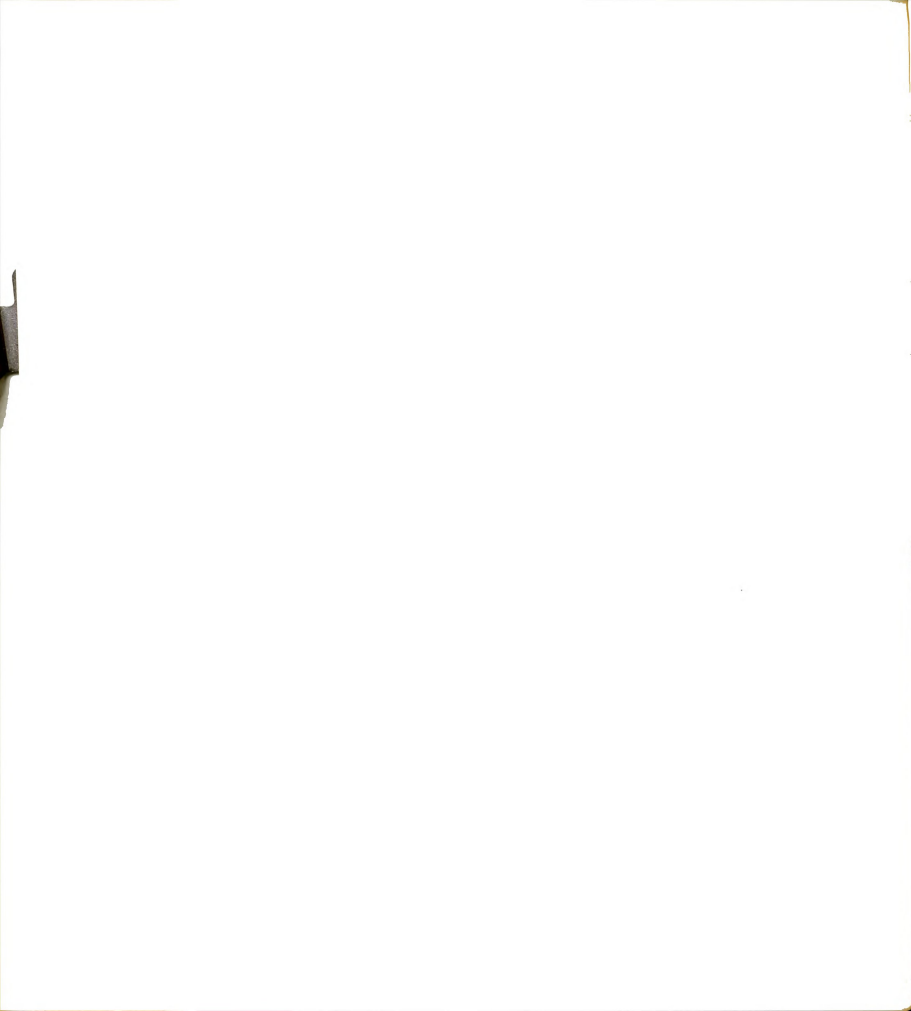
Initially, fertilizer distribution was the sole responsibility of the Department of Agriculture which used an hierarchy of extension officers as a sales force and an innovation diffusion team. The Agricultural Department showed significant progress in demonstrating the use of fertilizer to farmers and in developing "conscious" and an "unsatisfied sub-conscious" demand for fertilizer. The rationale was that only the public sector supported by inadequate funds could bear the high costs of market

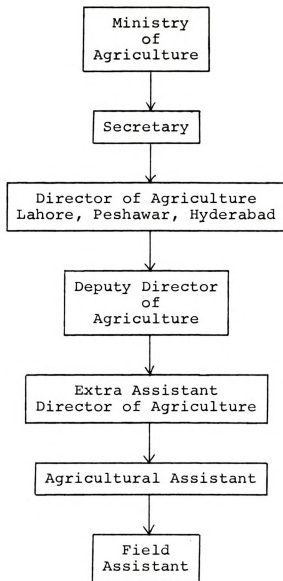


development and sales promotion. The effectiveness of extension organization proved itself in laying out fertilizer demonstration plots for the farmers through readily available fertilizers. In spite of the high rate of anticipated profitability and a rapidly rising effective demand for fertilizers, there were cases of occasional emergence of black market prices and shortages in the spatial supply of fertilizers. The reasons that can be put forth are the lack of profit motivation for the extension organization and lack of incentives for the extension workers, the bureaucratic inefficiency and shortage of personnel in the already overburdened Department of Agriculture. The major bottleneck in the sales organization of the Department of Agriculture was the lack of progressiveness to keep up with the growing demand for fertilizer and expanding geographical coverage, resulting in a declining ratio of sales personnel to the quantity of fertilizers sold, in addition to, the already low ratio of one extension worker for 1500 farm families.

In evaluation of the performance of the Department of Agriculture, Food, and Agriculture Commission noted,

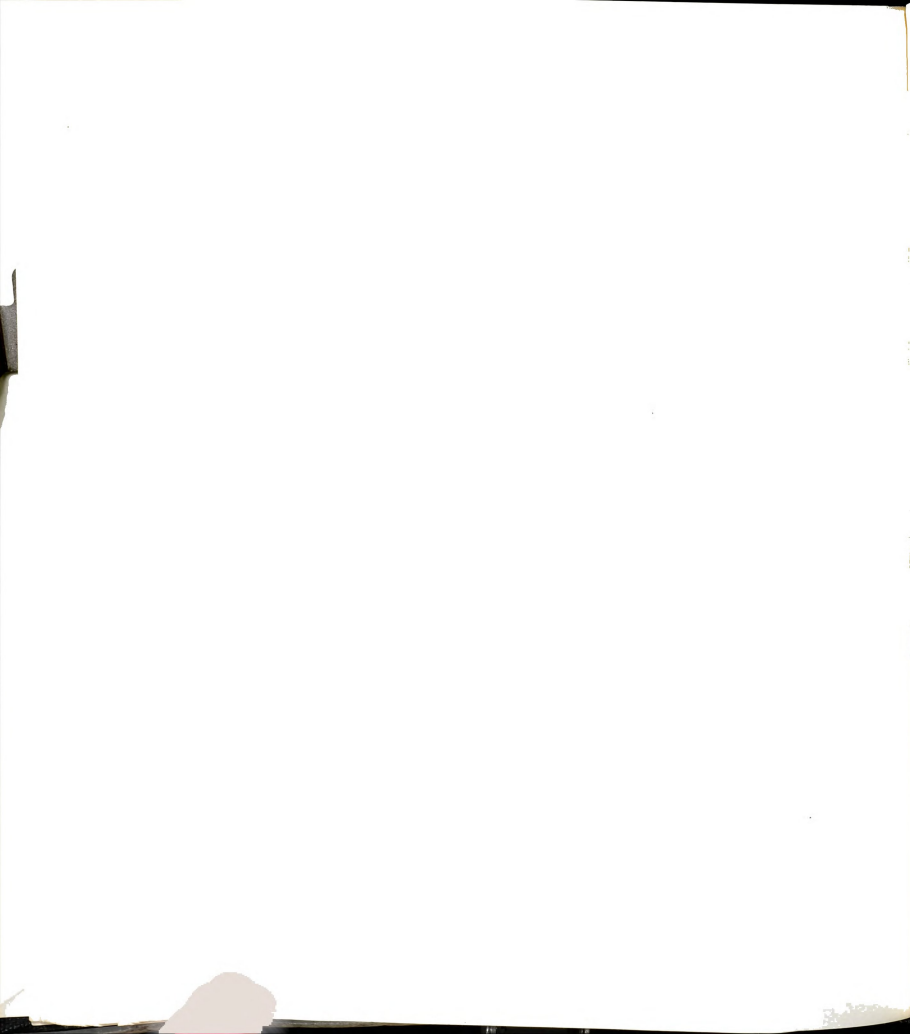
Department of Agriculture reflects the patchwork way in which all the handicaps of a minor provincial service starved of funds and low in public esteem are represented. Its original purpose was that of a very attenuated advisory service confined mostly to demonstration to rural leaders and larger landowners, . . . with totally inadequate personnel in the front line, it has, nevertheless,





Total Number of
Villages: 37,959
Total Number of
Farms: 4,859,983
Total Number of
Cultivators: 9,186,000

Figure 4.3. Organizational Chart of the Department of Agriculture.

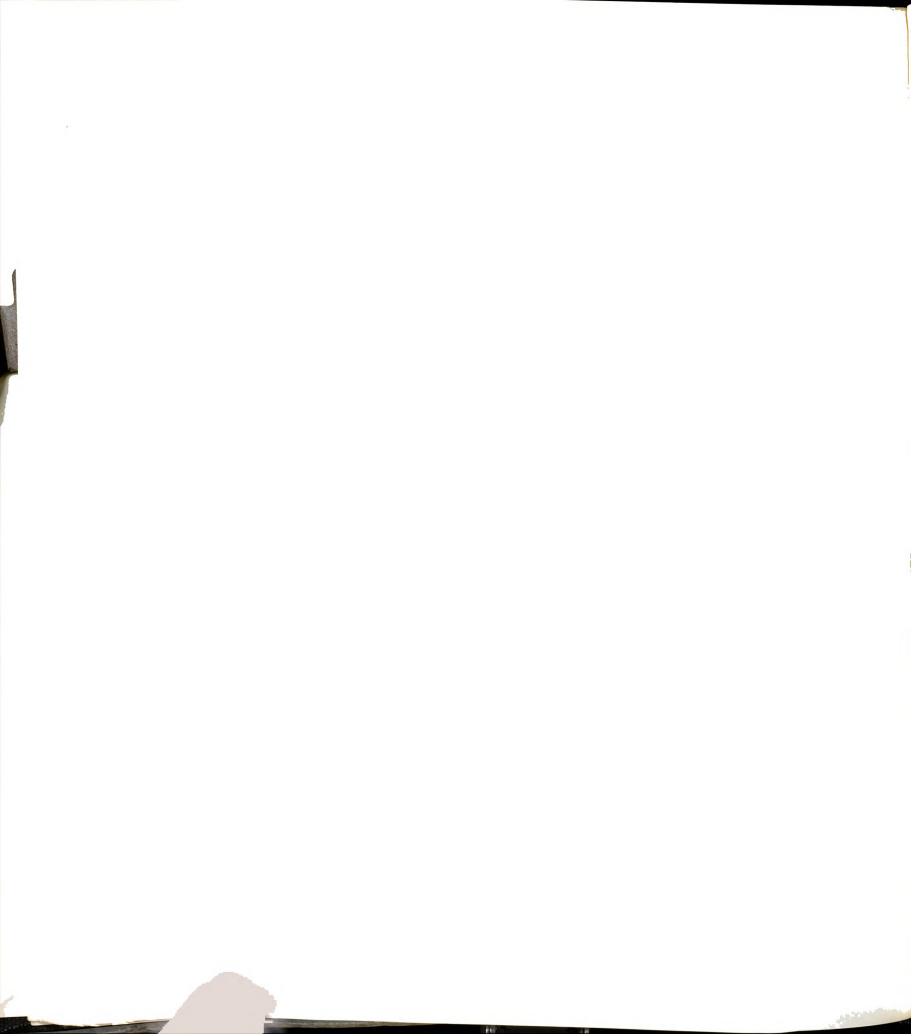


been the natural first medium to turn for handling the increasingly complicated claims of development. It has been called upon to expand extension and demonstration services, to supply fertilizers, to open and manage new seed farms, and to develop the completely new subject of plant protection, while the achievement is notable, it has inevitably fallen short of the needs.³⁹

Organizational inefficiencies emerged from the structure of the Department of Agriculture which was like an inverted cone, top-heavy with desk-bound administrators and supported on a small base of field workers having a fertilizer supply line combined into a loose organization which had neither the cohesion nor the desire to make the fertilizer distribution program effective. On the other hand, as various types of fertilizers began to be added to the product line, the number of distribution centers began to increase and indigenous production of fertilizers started supplementing the supply of fertilizers, the need for a new distribution agency with its own chain of wholesalers and retailers was felt.

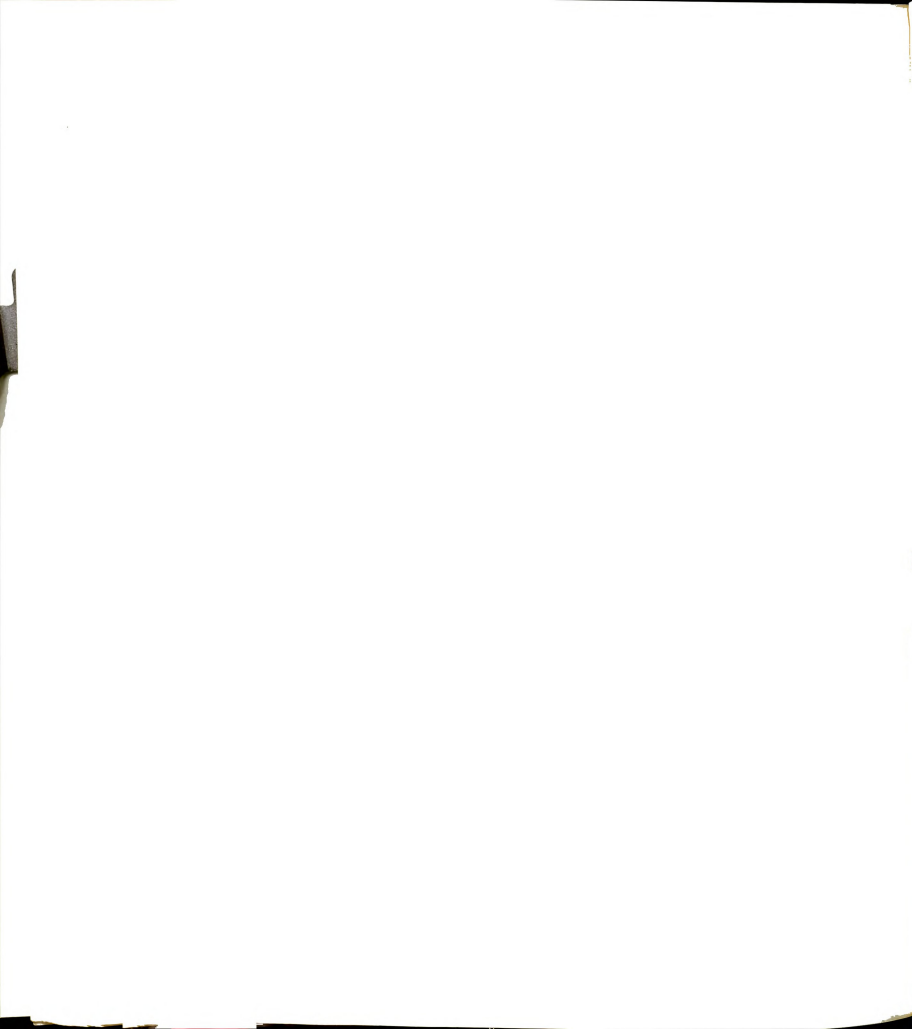
It was not until 1960 that the Food and Agriculture Commission recommended the formation of the Agricultural Development Corporation in West Pakistan with the sole responsibility of undertaking developmental activity in the new project areas being brought under cultivation and supplying farm inputs to farmers in the project and

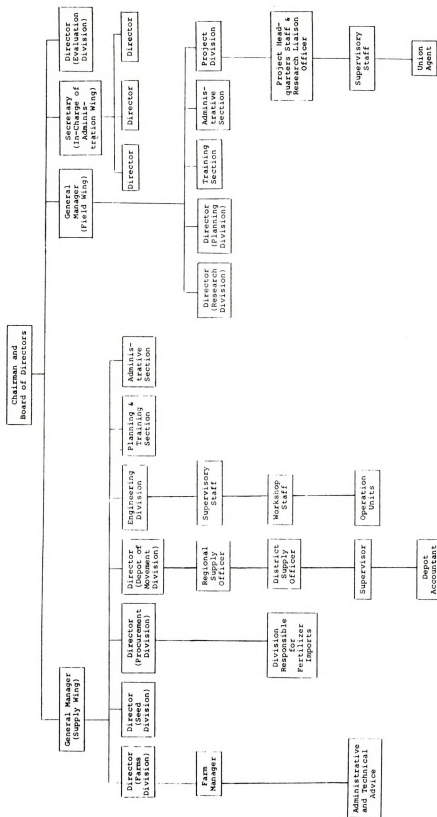
³⁹ Government of Pakistan, Report of the Food and Agriculture Commission, Manager of Publications, 1960, pp. 153-54.



non-project areas. The corporation structure consists of supply and field wings such that the operational work of each wing is organized under a general manager. The general manager of the supply wing has under him five divisions, each being headed by a director and two sections for planning and administration each. The procurement division has the sole responsibility for the procurement of supplies other than seeds, including fertilizers, plant protection, materials and equipment, and agricultural implements, etc. This involves the making of arrangements for the local manufacture of equipment and the import of necessary raw materials. A major function which this division performs is the procurement of imported fertilizers and distributing them to farmers in designated areas through a sequence of wholesalers and retailers.

The West Pakistan Agricultural Development Corporation (WPADC), a semi-autonomous body, emerged as a competent organization to handle the import of fertilizers. Among other things, its functions included the determination of fertilizer import requirements of West Pakistan to meet the in-country demands for fertilizer, to schedule tenders, and invite bids in accordance with the financial means available. After having made the awards for fertilizer shipment to the port of Karachi, WPADC was responsible for giving notices to the private





Source: Government of Pakistan, Report of the Food and Agriculture Commission, Lahore.

Figure 4.4. Organizational Chart of West Pakistan Agricultural Development Corporation

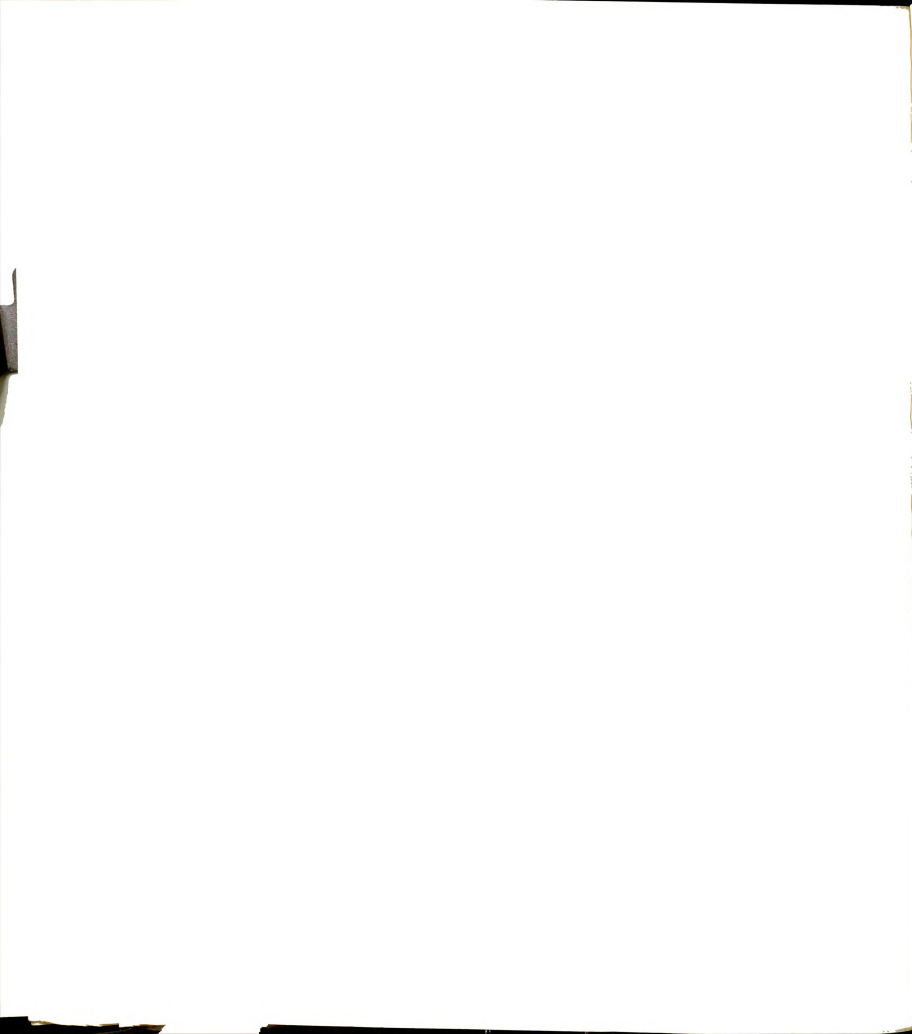
fertilizer distributors with regard to the availability of fertilizers at the port. It was responsible for clearing the shipment, unloading it, and arranging for railroad cars on the basis of its own scale of priority. After the fertilizers were discharged from the vessel at Karachi and loaded into railcars the problem of in-country movement rested with the Rural Supply Credit Corporation (RSCC) which through its own chain of 2000 cooperative service societies as selling agents, distributed fertilizers at the farm level on credit basis. This arrangement between WPADC and RSCC was discontinued at the end of June, 1963, as the RSCC was unable to collect outstanding debts of the cooperative societies. For the next eighteen months to July, 1965, fertilizer distribution was divided among WPIDC, WPADC, and RSCC. The allocation to the West Pakistan Industrial Development Corporation (WPIDC) of the quantity of fertilizer to be distributed was to the extent of 50 percent of the indigenous fertilizers and 25 percent of the imported fertilizers for distribution through private stockists. WPADC was allocated 50 percent of the imported fertilizers and 25 percent of the locally produced fertilizers for distribution among the farmers. The remaining 25 percent of the local production and 25 percent of imports were to be distributed by RSCC to some 2000 cooperative service societies. The rationale underlying the allotment of

percentage shares among the three agencies for fertilizer distribution among the three agencies so that fertilizers could be brought within the effective reach of the farmer. A greater proportion of indigenous fertilizers was allotted to WPIDC which was the only semi-autonomous body responsible for the local production of fertilizers. Similarly, WPADC received a greater share of imported fertilizers because of its major responsibility for handling the import of fertilizers. WPADC also came to establish a long chain of retail agents requiring a token cash deposit of \$42. In July, 1965 the system of inter-agency allocation of distributive shares was again changed and 75 percent of the total supply was allotted to RSCC for distribution through the various cooperative societies and all sales by WPIDC and WPADC through private stocklists were terminated. WPADC was allotted 25 percent of the total for its use in project areas and for the promotion of improved seed cultivation throughout West Pakistan.

A major change in the fertilizer distribution policy of WPADC was affected in August, 1967 to streamline the distribution system and to associate the private sector. Under the proposed fertilizer distribution policy, fertilizer was not to be distributed at the retail level by WPADC, but was to be sold on a wholesale basis to its commission agents who were to sell it in retail to the farming community. In contrast to the previous policy

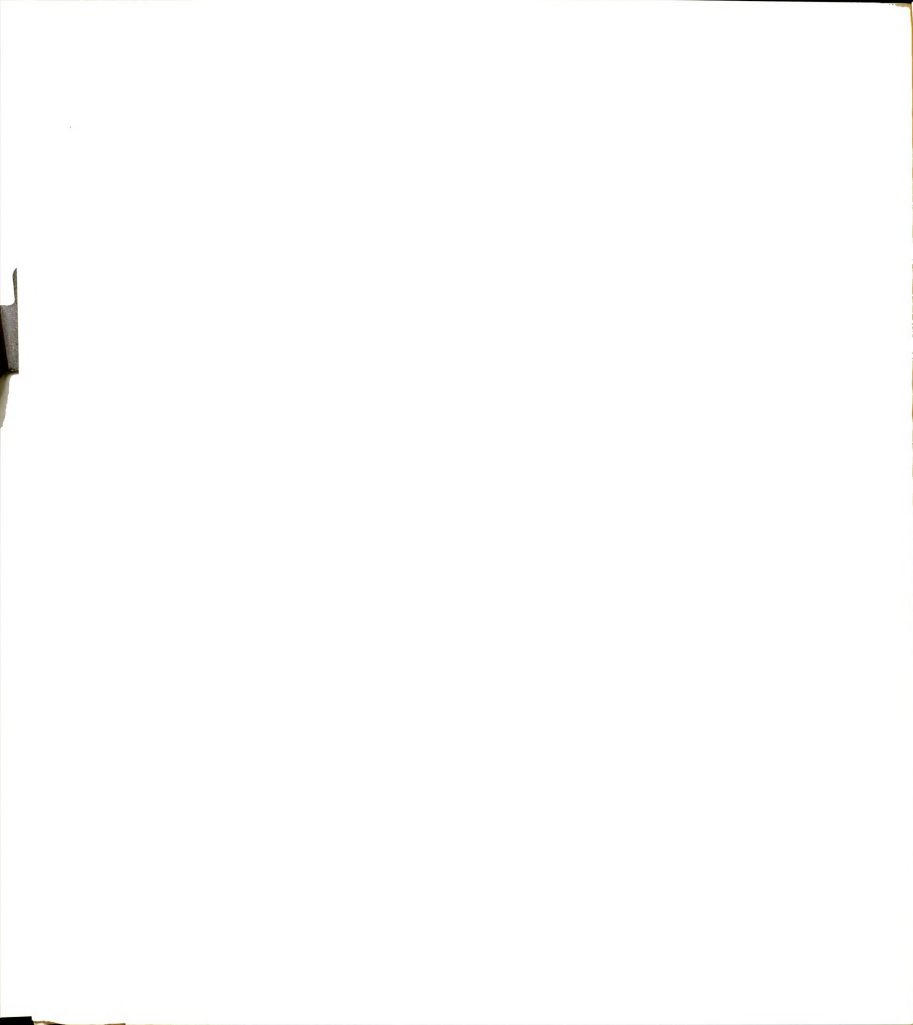
under which only 25 percent of the imported fertilizers were to be sold by the RSCC, the WPADC came to have an exclusive right on the handling of imported fertilizers. The wholesale operation was started through 211 wholesale depots in Peshawar, Sargodha, Lahore, Multan, Sukkur, and Hyderabad regions which were to supply fertilizers to 2400 commission agents having dealing connections throughout West Pakistan. Whereas each commission agent was bound to lift at least 400 bags of fertilizer from wholesale depots and in order to enable the commission agents to cover the expenses to be incurred by them for transporting the supplies from the corporation depots to their own premises, a surcharge of 21 cents per bag of urea and triple superphosphate and 12 cents per bag of ammonium sulphate and nitrate was allowed for.

The failure of the WPADC system of distribution through private stockists indicates that their principal weakness was their inability to provide fertilizers in the right place and at the required time. Private stockists were reluctant to carry significant quantities of fertilizer in advance of farmer demand, because of the deliberate practice of obtaining higher prices from farmers during periods of peak demand. Some of the loopholes of the system were lack of supply depots to backstop the private dealers, a limited number of commission agents who could not ensure the availability of fertilizers in



most of the mandi towns; and lack of efficient and enterprising dealers with a sufficient financial resource base who could carry adequate inventories to permit cash and carry sales to farmers. A major factor operating as a disincentive to the private dealer is the low-profit margins or fixed incidentals determined by the government through a system of comprehensive control of fertilizer prices. At current prices the profit margins on the sale of urea amount to 9 percent in West Pakistan as against 11 percent in East Pakistan; and sometimes dealers have to bear godown rent and some other charges out of this profit margin. It would, however, be well-advised to increase the profit margin from 20 to 25 percent of all fertilizer sales. Its net effect would be to increase the rate of return to investment in retailing business and thus to attract more capital, talent, and better marketing service into it.

Under the current system of fertilizer distribution involving the participation of private sector, WPADC is allowing private distributors four months free credit from the date that fertilizer is delivered to them at Karachi. Distributors, on the other hand, demand from agents, either a deposit prior to shipment and/or full payment prior to the cars being released to the agent at the up-country railroad heading. It has done an admirable job of building up a distribution system that has effectively moved the fertilizer products to the



farmer and has stimulated increased fertilizer consumption. The success of WPADC in increasing fertilizer consumption has made it possible to create an environment that now allows the private sector to enter fertilizer manufacturing, marketing, and distribution on a profitable basis.

The cooperative organization constitutes a vital link in the system of fertilizer distribution in West Pakistan. Whereas its functions include the supply of fertilizer and other farm inputs to farmer-members, it generates free rider effect for the non-members, except for a few privileges which can be enjoyed by the cooperative members only. Since it procures fertilizer and other farm inputs at the officially prescribed price and supplies them to the farmers at the least possible cost, it represents a symbol of backward integration in the hierarchical organization which has a built-in credit supply line to meet the cash requirements of farmers. On the other hand, as a non-profit organization it seems to lack the initiative and drive of a profit-motivated private enterprise and an efficient management that could handle the growing volume of fertilizers. Due to the high private costs and lower private returns that accrue from the fertilizer education of the illiterate farmers, it lacks a solid financial base to bear the costs of mounting an adequate propaganda effort and to provide auxiliary marketing services which are the sine qua non of an efficient marketing system.

It was with the transfer of fertilizer distribution functions from the Department of Agriculture to WPADC in 1960-61 that a major void in the distribution system of fertilizers was found. Whereas WPADC could adequately perform the functions of procurement, it lacked a viable institutional framework to channel the flow of fertilizers to farmers. Since the Cooperative Department which had the sole responsibility of extending credit to the farmers through a chain of cooperative credit societies throughout West Pakistan, it came to assume an additional responsibility of supplying fertilizers and other farm inputs to farmers. Until mid-1963, the only agent for fertilizer distribution in West Pakistan was the Rural Supply Credit Corporation (RSCC) which utilized its nearly 2000 cooperative societies as selling agents on credit basis. This was discontinued at the end of June, 1963, one of the reasons being that RSCC was unable to collect outstanding debts of the cooperative service societies. Furthermore, the organizational structure of cooperatives in West Pakistan was primarily meant to meet the credit needs of farmers and an additional function of farm input supply complicated the managerial functions which resulted in the accumulation of fertilizer stocks at various levels of the distribution system and also hampered the smooth flow of sales revenues. In addition, RSCC did not have the flexibility adequate to handle a larger volume of fertilizers so as to meet the requirements of a rapid



rate of fertilizer offtake at the farm level. The volume of fertilizers available for distribution was so divided among the three agencies (referred to above) that RSCC got a quota of 25 percent of local production and 25 percent of imports. The cause of this reorganization in the distribution system was the inability of supply to keep pace with demand and emergence of black market prices from time to time.

In July, 1965, the system of fertilizer distribution was again reshuffled and RSCC was allotted 75 percent of the total available supply of fertilizers to be distributed through its cooperative service societies. This reallocation of fertilizers was brought about as a temporary arrangement to curtail some of the existing black market practices in fertilizer sales. Subsequent changes in fertilizer distribution brought about a change in the process of fertilizer allocation between WPADC and RSCC on a fifty-fifty basis. After 1967, the supply of fertilizer has been handed over partly to the private sector as given in Table 4.1.

The structure of the Rural Supply Credit Corporation is such that it links the District Committees through service societies to Union Councils which constitute the basic distributive unit for fertilizers. Fertilizers which are available for distribution constitute 50 percent of the indigenous production and pass through the fertilizer flow channel as illustrated in Figure 4.5. The

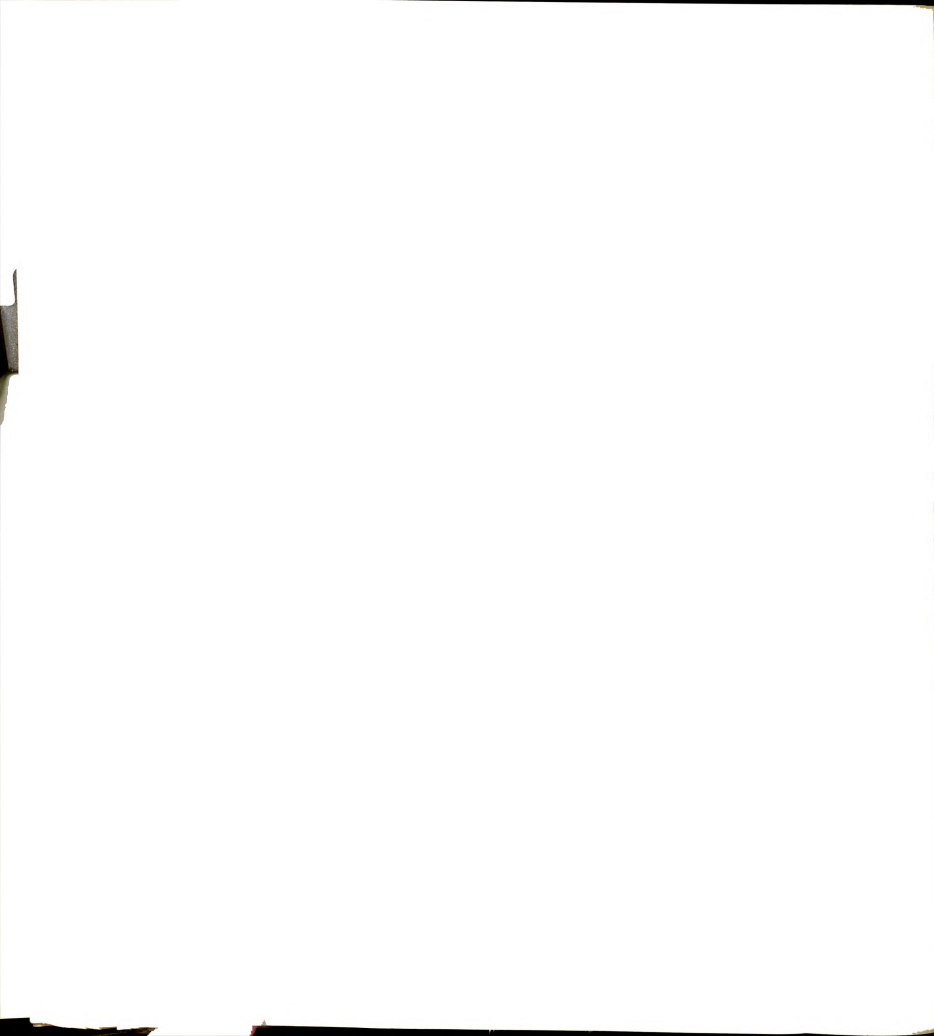
TABLE 4.1. Inter-Agency Allocation of Fertilizers.

Nature of Fertilizer	Fertilizer Distribution Rights with Various Agencies				
	PNO*	Esso*	Jaffersons	Dawood	ADC
	(percentage)				
Imported Fertilizers Allocative Share	28	18	18	18	18
	RSCC		PNO		
Indigenous Fertilizers Allocative Shares		50		50	

*PNO = Pakistan National Oil; Esso = American Oil Company.

Source: Government of West Pakistan, Planning and Development Department, Lahore.

Provincial Allocation Board distributes the available supplies among three regions of Lahore, Hyderabad, and Peshawar which again passes on to the District Committees constituted by deputy commissioners, assistant registrar of local cooperative societies, and representatives of the Department of Agriculture and basic democracies. The list of eligible cooperative service societies is usually prepared by the assistant registrar of cooperative societies. This places him in the position of determining who receives fertilizer and cooperative service



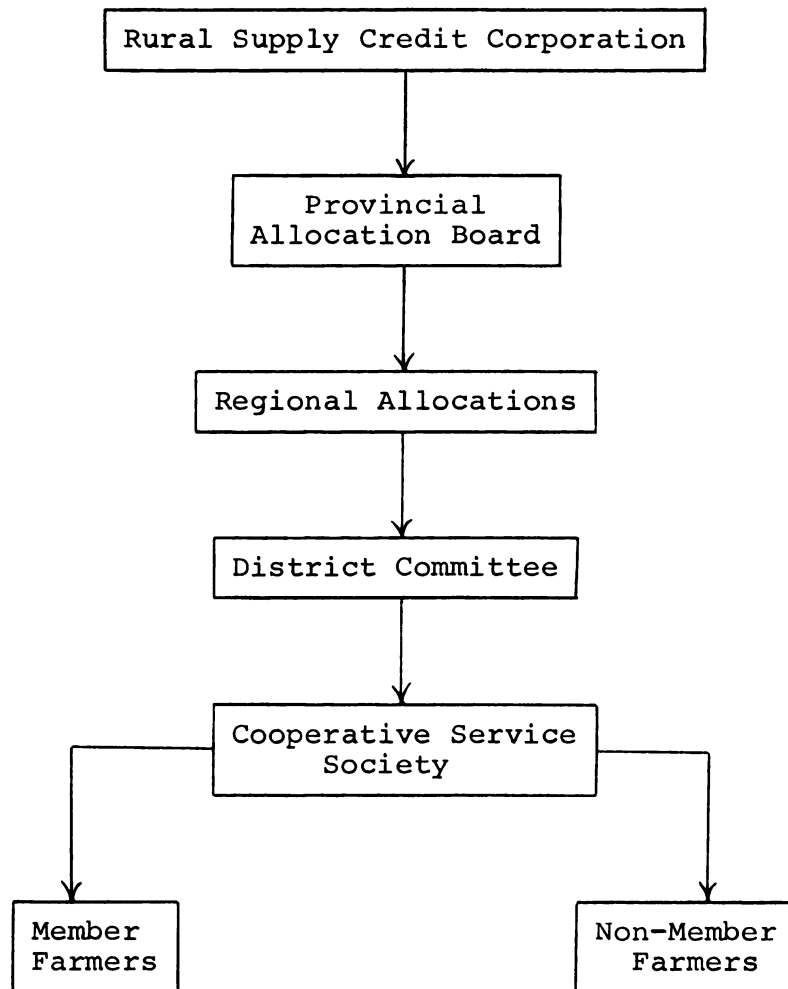
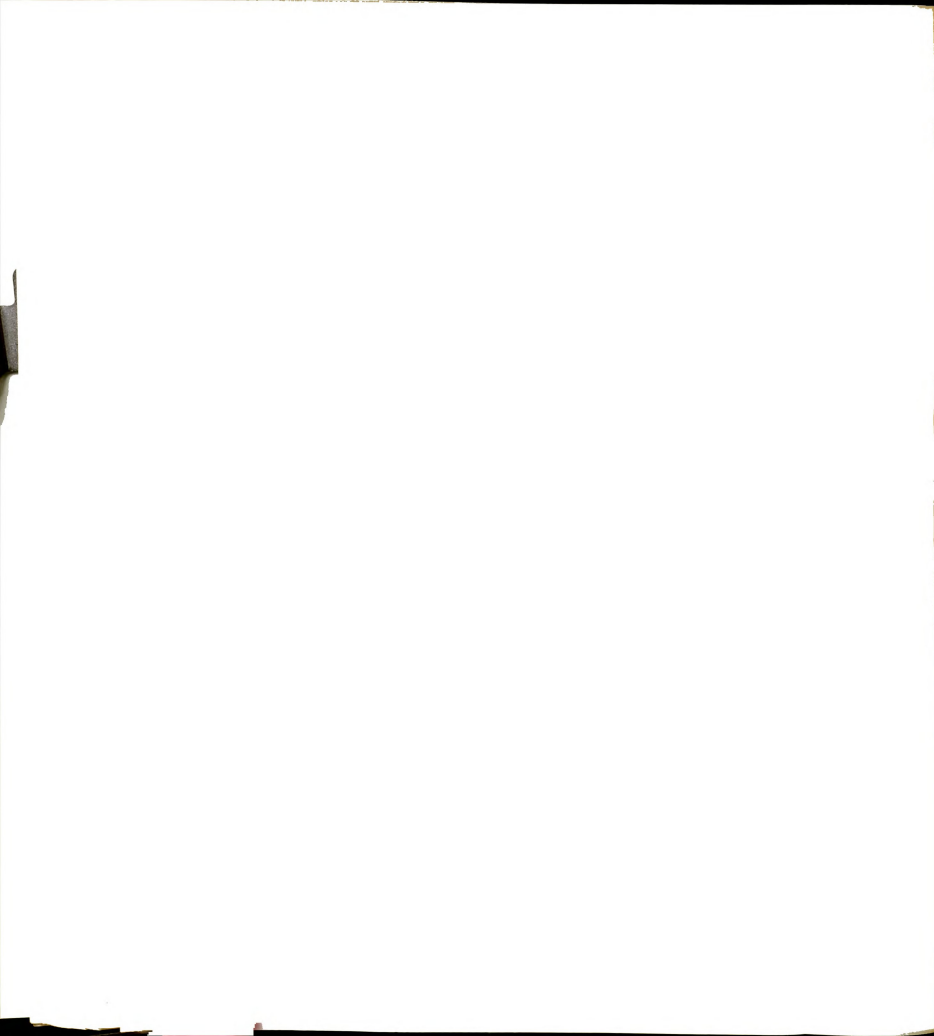


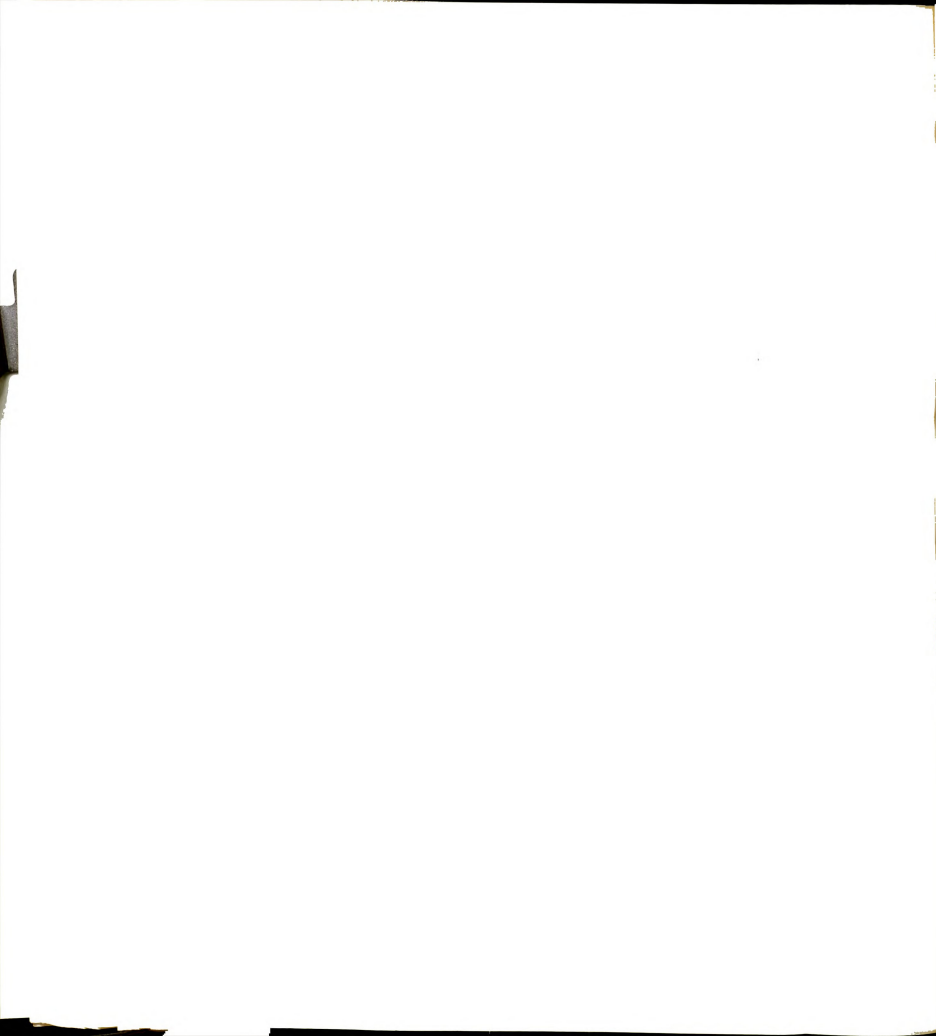
Figure 4.5. Flow of Fertilizer Through the Distributive Outlets of Rural Supply Credit Corporation.



societies with outstanding debts are seldom declared eligible.

At present, there are 3,218 union councils⁴⁰ in West Pakistan within which 2,570 cooperative service societies have been formed with a total membership of 91,387. Some 1,200 societies of various types, i.e., service, credit, development, etc., are reported to have been active in handling fertilizer since July, 1965. The societies sell fertilizers to non-members as well as members, but the extent to which this is done has not been quantified. According to the Bureau of Statistics, 2,176 union councils in West Pakistan are located predominantly in irrigated areas where the intensity of fertilizer demand is relatively high. Even under the general assumption that all of the 1,200 societies referred to above are within the irrigated areas, this would be only one fertilizer outlet for two union councils. This is grossly inadequate when it is looked upon as the principal source of making fertilizer available to the farmers at their doorstep. One of the principal weaknesses of this system is that union council being basically an elected body involving a variety of social, economic, and political objectives, its selection as a

⁴⁰Union councils are basically a political unit which also help perform such public-supported programs which are useful for the community.



basic distributive unit is based on administrative rather than functional considerations. The hierarchical structure of cooperative distribution system places immense demands on the technical competence of managers of cooperative service societies and secretaries of union councils most of whom tend to be unqualified, half-educated white collar workers.

The Rural Supply Credit Corporation requires no cash deposit from the cooperative service societies. They are, however, required to send cash payment with fertilizer orders and pay past debts which may or may not equal the amount of fertilizer sales. Since advance order placement limits the quantity of fertilizer to the number of assured buyers and with almost no revolving inventory of fertilizers at the basic distributive units, the magnitude of fertilizer sales is likely to remain below the desirable limit. Whereas the cooperative members have the benefit of fertilizer sales on credit, the non-members must pay cash for the amount of purchase or seek credit from non-cooperative sources. Bottlenecks in the system of fertilizer distribution through RSCC occur when farmers fail to follow prescribed procedures. If farmers form cooperative societies and deposit the required share capital in the cooperative banks then the banks will assume the responsibility of advancing fertilizer credit and the system of recovery of sales revenues would work smoothly. Thus, it

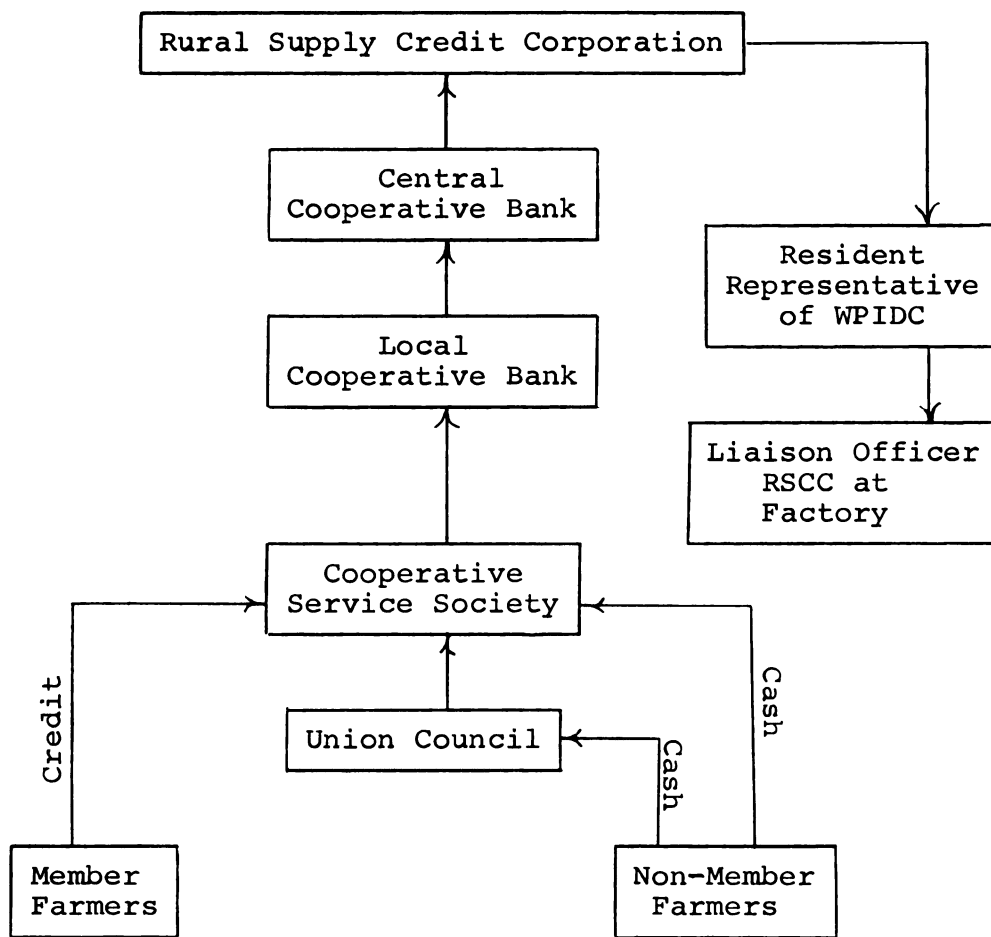
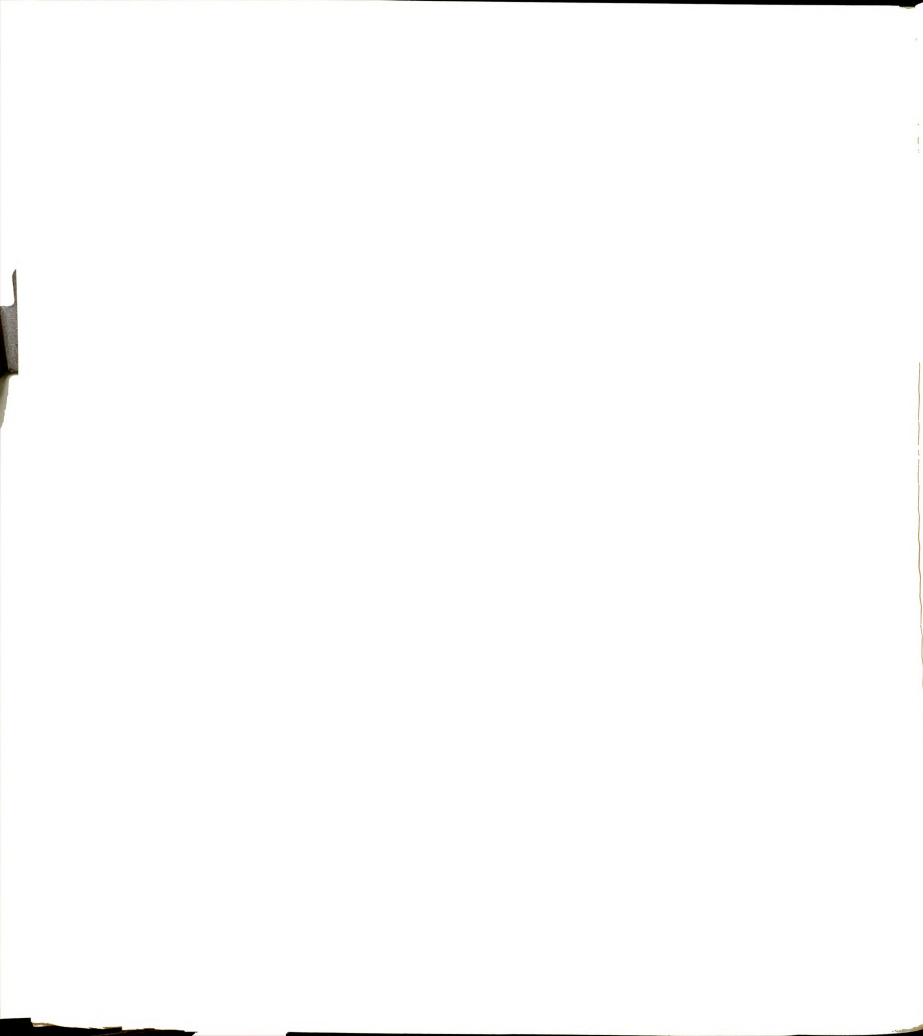


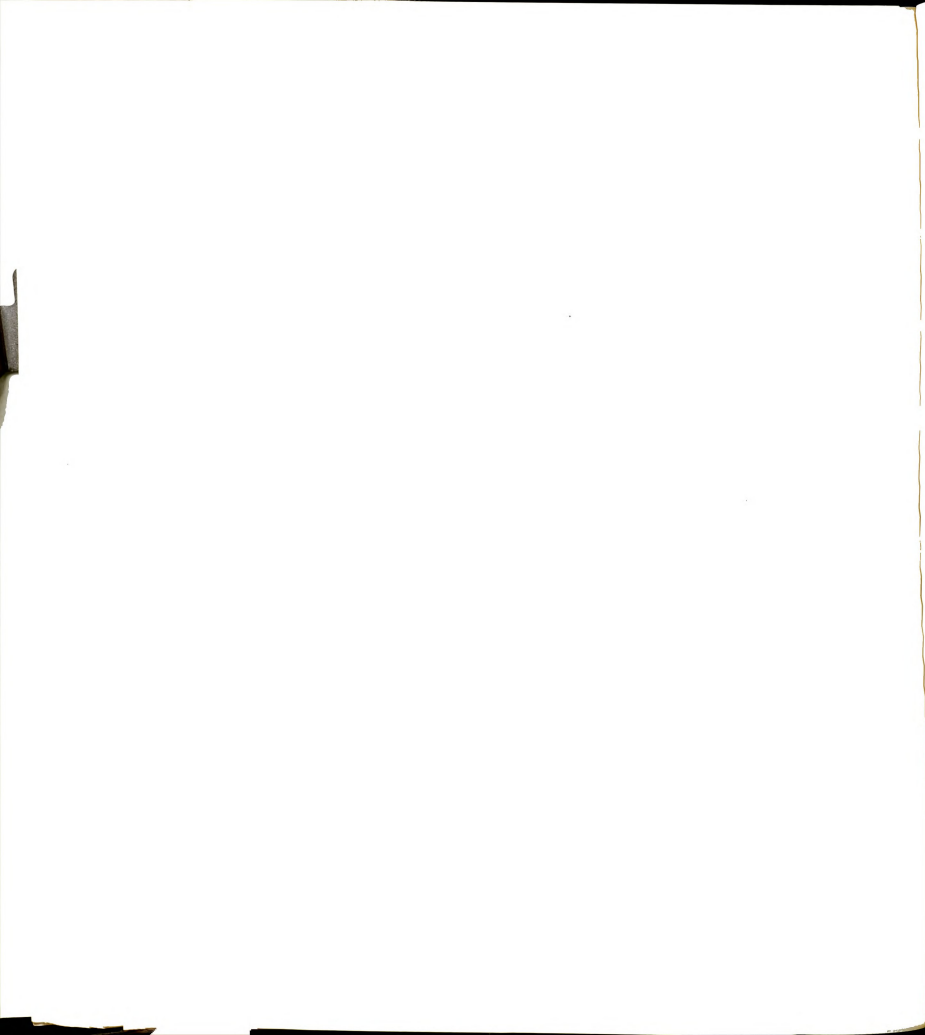
Figure 4.6. Flow of Sales Revenues and Advance Order Placement.



would require an active participation of the farming community in order to obtain the services of a strong cooperative distribution system. It may be asserted that the cooperative input supply system has proved to be a real asset to the farming community by bringing the modern farm inputs within the easy reach of participating members. In addition, it has a real social value in breaking the traditional inertia of farmers and provoking their interest in using new scientific knowledge for the improvement of their farming conditions.

It would, therefore, be desirable that:

1. The additional services offered by the cooperative societies with fertilizer sales to farmer-members must be increased and terms and conditions of entry for the non-members be made easier.
2. Instead of the practice of equitable distribution of dividend, it may be calculated annually in accordance with the society.
3. No initial share capital may be demanded from non-members except for a moderate membership fee.
4. Share capital may be accumulated gradually from the dividend due to each member. Dividend or part of it should only be

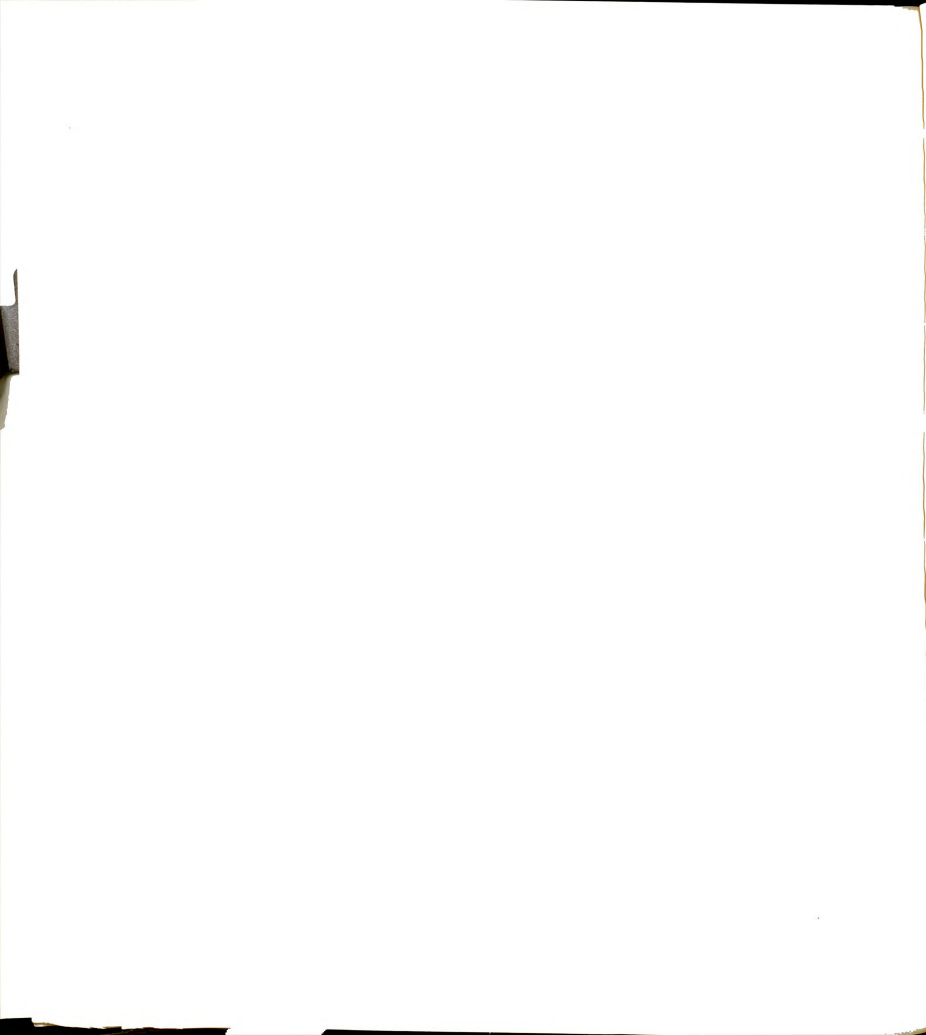


actually paid to the member when a certain percentage of his share capital has been paid up.

5. The societies be entitled to pay quantity allowance on individual orders.

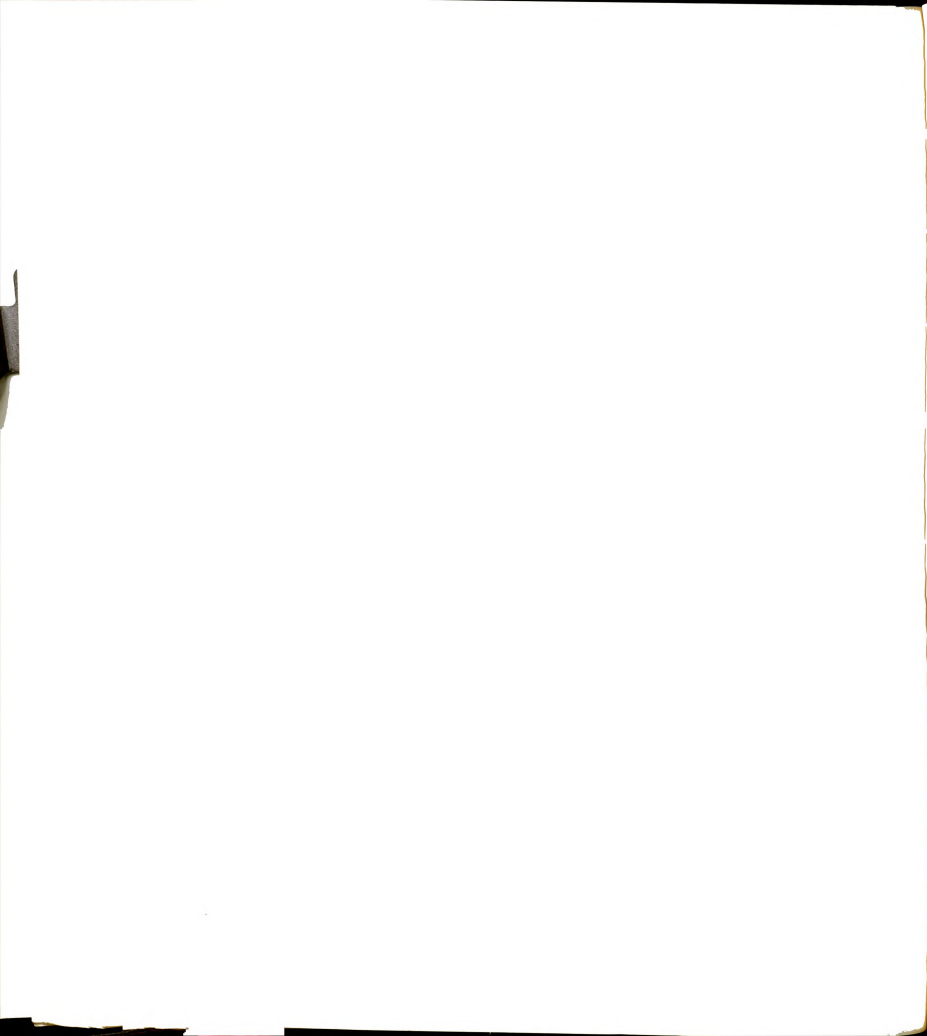
It may, however, be pointed out that the procedure of allocation from top to down does not give adequate consideration to actual farmer's demand and their willingness to purchase. Rather, prior years crop acreage figures are used and multiplied by the number of bags per acre recommended for various crops. It will, therefore, be desirable that the procedure of demand assessment be revised and three-fourths of the allotments that are made to cooperatives should be made on an annual basis and that the remaining 25 percent should be used for seasonal adjustments. Also, the allotment should be designed for a continuous delivery throughout the year so that orders could be placed in advance of the planting season of each crop.

The procedure for ordering fertilizers is unnecessarily long, complicated, and time-consuming. The actual order passes through seven offices and this procedure requires at least two months for processing of orders and delivery of fertilizer. Since cash payment is required upon placement of the order, the farmer's cash is tied up for this period of time, unless of course, he is a member of a society with credit arrangement. The shortage of railroad cars is often cited as the cause for delay in



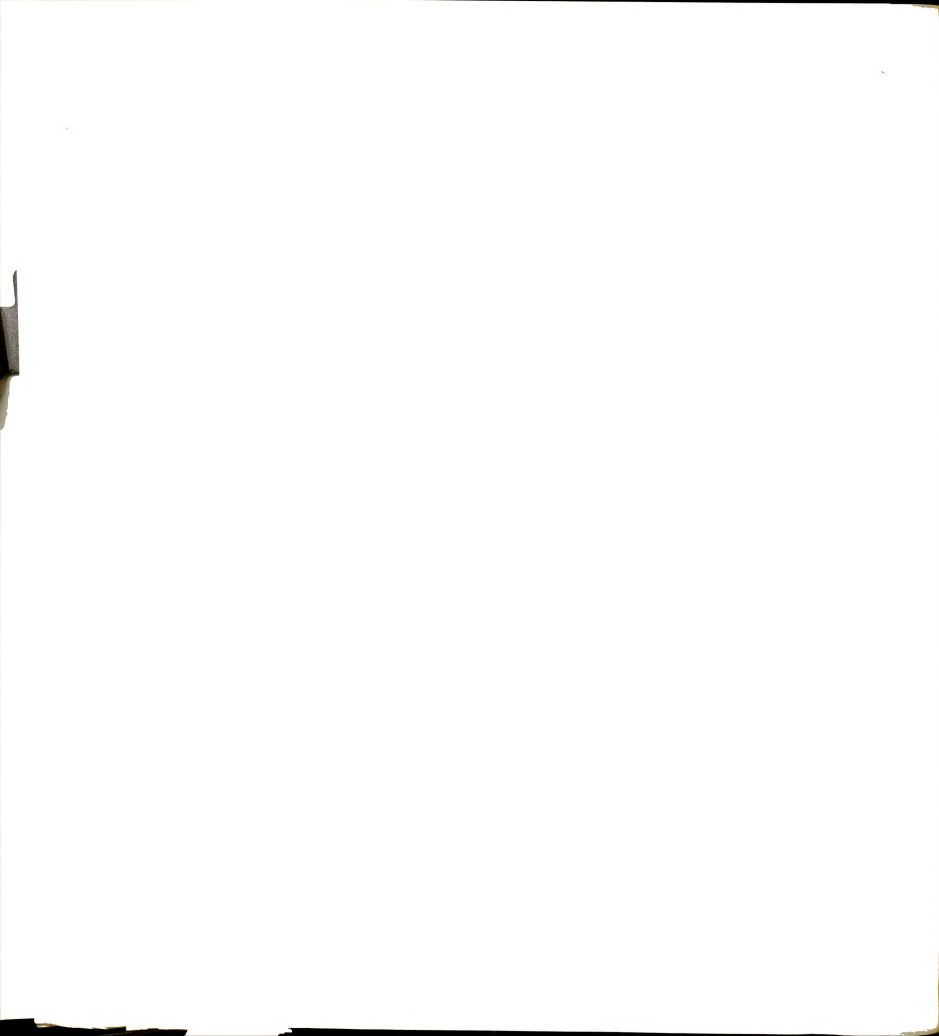
delivery. Orders for fertilizer are placed on a quarterly basis, but due to the delays arising from the procedure of order placement and inefficiency of transport, it is often two months after the beginning of the quarter before the first shipments begin to arrive. In the event that total quarterly allotments are not delivered, no carryover of the allotment to the next quarter is permitted.

Because of the complicated process through which the sales revenues flow, part of the big dues get swallowed up by the inertia of the remittance system in the form of malpractice or mismanagement of accounts. It is claimed that cooperative banks delay the transfers to capitalize on their own transactions. The process of transmission of sales proceeds can, however, be improved by giving option to the fertilizer suppliers in each instance to have the sales proceeds transmitted either through the cooperative banks or through postal money order or have them transferred through the private banks if the cooperative banks fail to remit promptly. The flow diagram indicates the process through which an order placed by the member and non-member farmers passes through the cooperative service societies to local cooperative bank, central cooperative bank, and RSCC to resident representatives of WPIDC and forwarded to liaison officer of RSCC at WPIDC fertilizer factory.



In order to ensure a proper handling of accounts, it would be desirable to replace the present system of accounting by a clear-cut double-entry accounting system and with a streamlined standard set of ledger accounts. Facilities for training the needed personnel can, however, be provided if the substitution of the new accounting system for the old single-entry system is worth the cost. Measures aiming at centralized bookkeeping may be advocated since: (1) it would lessen the demand for highly qualified local management, and (2) it would facilitate the compilation of data and turn them into a valuable instrument for planning.

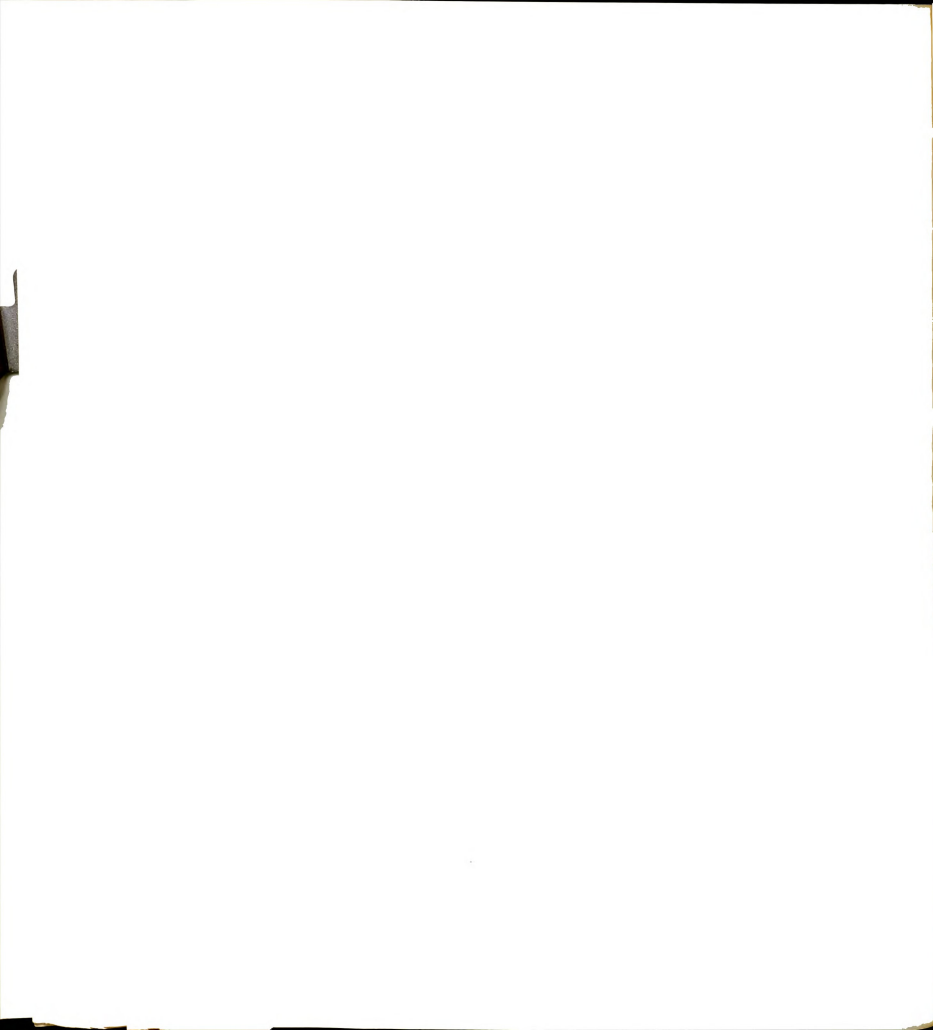
Available evidence indicates that the local cooperative service societies do not maintain a proper record of fertilizer sales, and rate of stocking and an accurate assessment of the demand for fertilizer would, therefore, be difficult. In addition, the primary evaluation of demand requires a certain managerial maturity; the local service societies will thus not be able to form a clear idea about the actual demand and its fluctuations. In this case it is assured that at the equilibrium level supply is equal to demand at the officially prescribed price which remains almost fixed during the whole year. Thus an indent system carried out by RSCC supervisors could not be expected to function very well, especially when the local people notice that their estimates are disregarded. To make the indent system function properly,



two elements are necessary: (1) thorough local knowledge of the market and its seasonal fluctuations, and (2) prompt and accurate communication.

In general, the formation of cooperative service societies has just added to the responsibilities of the field staff of the cooperative department without any compensation in the form of specialized training, additional staff, and better transport facilities. In order to improve the information processes, opening up of inter-society flow of fertilizers and as a step towards horizontal integration, the flow of communications through various administrative bodies should be made not only vertically, but also horizontally. In addition, the cooperatives must be encouraged to streamline the system of fertilizer distribution with a view to: (1) maintaining low handling costs, (2) to permit timely delivery to farmers, and (3) to ensure adequate geographical distribution of sales outlets. It would, therefore, be desirable if a semi-annual evaluation of these factors were made as a criteria for determining adjustments in the allocation of total fertilizer supply to the cooperative system.

Originally fertilizer was sold through the Agricultural Development Corporation which, in turn, appointed RSCC as its sole agent thus, in fact, providing the cooperative sector with a monopoly on fertilizer. For a number of reasons, the system was abandoned in January,



1964 and the WPIDC started contemplating the appointment of their own agents in about four hundred towns and mandi towns. The imported fertilizer still remained with WPADC and RSCC and the structure of distribution was accordingly split into parallel lines, one of them being WPIDC involving the ownership rights of indigenous production and establishing a chain of wholesalers and retailers for fertilizer distribution. WPIDC demanded a cash security of Rs 5000 per retailer while distributing fertilizers through 500 private stockists in over two-thirds of the districts in West Pakistan. Further, improvements could be expected as additional competition was brought about by increasing the number of private stockists. The appointment by WPIDC of private agents really was a reintroduction of the system in force before the cooperatives entered the stage with the exception that at that time wholesale distribution and appointment of agents was the responsibility of the Agricultural Department.

That the fertilizer distribution system did not prove a success under the erstwhile organizational structure can be evaluated from the following statement:

Fertilizer was often costly to the cultivator despite the subsidy, because the distribution system was inefficient. Distribution was in the hands of government agencies, semi-autonomous corporation or cooperatives. That these agencies were often inadequate in performing their task is obvious from letters in newspapers, sample surveys and field observations. Some distribution points were closed for days; fertilizer was often out of stock; there was red tape in

obtaining it; and stores were too far from many villates. The distribution system was simply inadequate.⁴¹

The active participation of private enterprise in fertilizer distribution was restricted because of the lack of basic infrastructural facilities and marketing services, and due to high probability for new capitalists to go for overhead investments involving a broader diffusion of returns. The instability in the fertilizer market brought about by abrupt changes in subsidy, adversely affected a private investor's expectations about his returns from the uncertain fertilizer market where the expressed conscious demand had not been established involving a high probability of loss of money for the firm which is "breaking the ice," to lose money in early years of operation. On the other hand, a limited amount of gross mark-up⁴² on fertilizer sales amounting to 10 percent, offered little incentive for private enterprise to invest money in fertilizer distribution whereas he could obtain higher returns from alternative investment.

After a long period of hesitance, the private sector due to uncertainty of returns in the fertilizer market, some of the private enterprises decided to enter

⁴¹Gustav F. Papnek, Pakistan's Development--Social Goals and Private Incentives (Cambridge: Harvard University Press, 1967), pp. 168-72.

⁴²Gross mark-up is the only available gross estimate of the rate of return from fertilizer.

into the distribution sector to capture the benefits yielded by a tremendous spadework that had been undertaken by the public agencies. Currently the prospects of fertilizer demand expansion are greater and the need for private investment capital to engage in import substitution are more apparent. How far the private enterprise is going to invest in basic infra-structural facilities, provide marketing services, stimulate the demand for fertilizers through farmer education, sales promotion, and marketing effort depends on the discounted rate of return to investment and the extent to which it can internalize the external economies. It was not until the latter part of 1967 that private enterprise showed active interest in the production and distribution sectors of the fertilizer industry. Pakistan National Oil was the first to enter into the distribution sector with its own private organization in November, 1967. The strategy of government was to gradually replace the existing public and semi-public organizations with private enterprise with the exception of those areas where the retainment of public institutions was considered necessary. An interesting feature of PNO has been the spectacular growth in fertilizer sales within the shortest possible time since its inception to the extent that it claims a share of 50 percent of the indigenous production and a greater share of the imported fertilizers than any other private agency. Within a period of three months until February, 1968, fertilizer



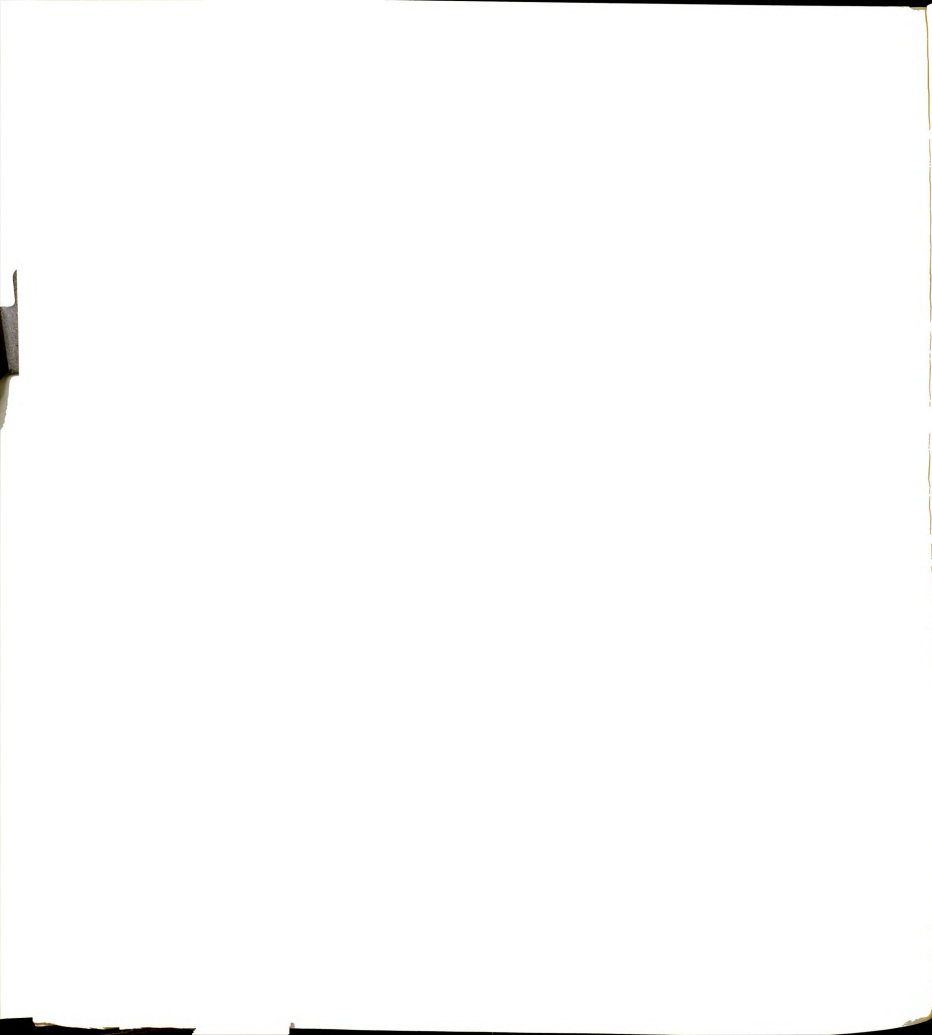
sales reached the level of 103,771 tons in terms of ammonium sulfate. Pakistan National Oil was followed by Esso and Dawood Corporation, each of which maintains its own chain of wholesalers and retailers with their marketing areas sometimes overlapping and sometimes distinctly separate. The most significant addition to the chain of fertilizer distribution agencies has been the addition of fertilizer company which with its new technical knowledge and organizational structure plans to float a vertically integrated distribution system consisting of its own chain of wholesalers and retailers assisted by a team of agricultural experts to advise on the use of fertilizers. While the magnitude of private organization in the fertilizer distribution system is still embryonic, it may be said to be passing through the learning curve.

The fact that the fertilizer distribution system of West Pakistan has not operated satisfactorily is reinforced by the evidence that in half of the districts of West Pakistan, there was only one dealer for 10,000 or more farms and over 400,000 farms were located in districts with no dealer at all.⁴³ Apart from the lack of adequate fertilizer distribution facilities in the form of fewer distribution centers and warehouses with the attendant complications of insufficient transshipment facilities, the

⁴³Papnek, Pakistan's Development--Social Goals and Private Incentives, pp. 145-56.



major problem arises in the lack of coordination between private sales effort and public extension activities. The administrative separation exists between the hierarchical structure of agricultural extension department and fertilizer distribution agencies at both the wholesale and retail levels. There may be some logic behind the administrative separation of specialized fertilizer extension personnel and fertilizer distribution, nevertheless, this organizational division represents to a considerable extent a "deskilling" of wholesalers and retailers whose functions are merely reduced to the transfer of fertilizer rather than passing on scientific information to the farmers. The wholesale dealer is largely a warehouseman or breaker of bulk while the retailer is a private commission agent who is a licensee of WPADC. He obtains fertilizers at a slight discount and his functions are mainly restricted to over-the-counter filling of farmers' orders. Since the primary efforts for the stimulation of demand for fertilizers have been largely taken out of the distributor's hands through the fixation of fertilizer resale prices, it becomes difficult for them to play an active role in the marketing process. Even though an increasing sales volume is likely to increase total returns depending upon the elasticity of demand, the returns to investment in sales promotion and extension activities are such that they tend to be broadly diffused. Besides, the guaranteed margins provided by the government do not allow for

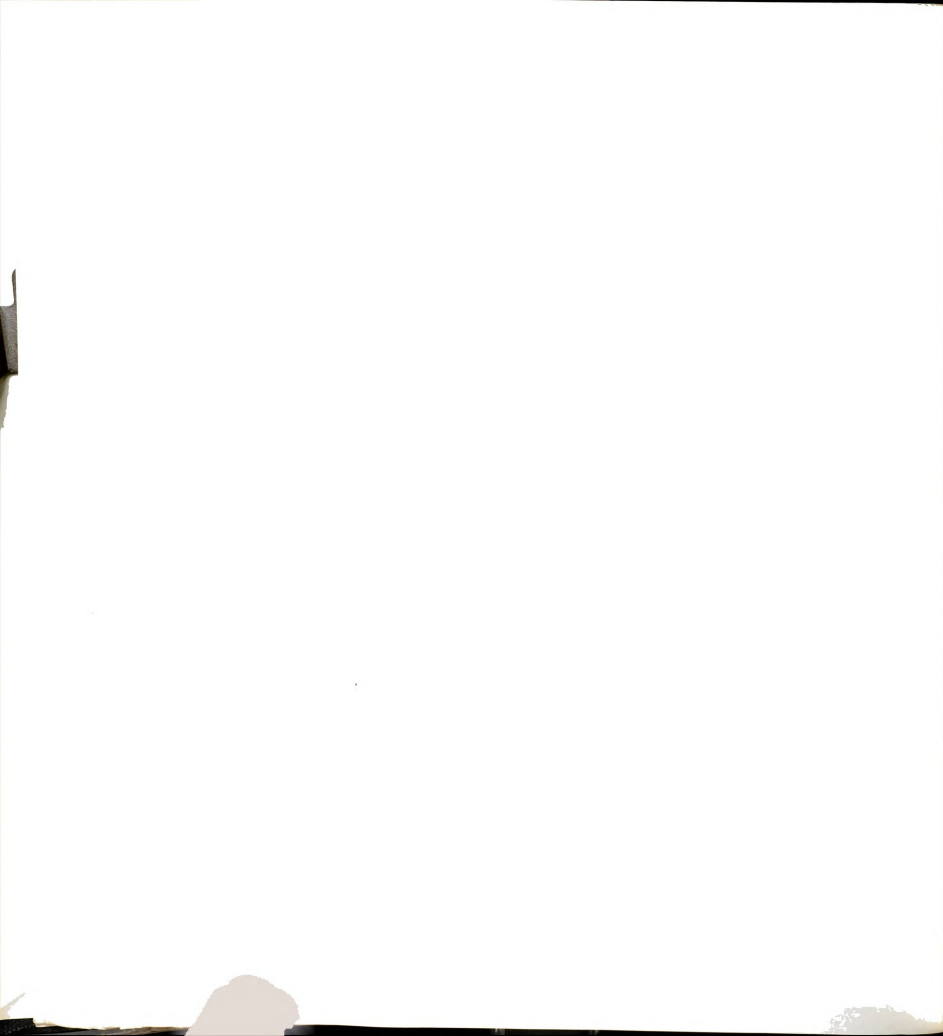


favorable returns for other than selling activity. The distributors tend to be active in the sense that specific decisions that could lead to the expansion of sales are largely delegated to others. Their role, thus, becomes primarily that of order-taker, rather than that of active stimulator of demand.

In general, the environment at wholesale and retail levels is often not competitive and, in some cases, cooperative organizations have more or less monopoly franchises for distributing fertilizers in specific areas. The locational monopoly tends to be perpetuated, due to the limitation of farmers to only a single outlet, whereas the costs of reaching an outlet other than the nearest one tend to be prohibitive. In addition, the currently operating system of fertilizer distribution is neither adequately decentralized nor does it provide for sufficient number of distribution centers so as to provide an efficient marketing service to widely dispersed farm-producing units.

The Proposed System of Fertilizer Market Channel Organization

A proposed system of channel organization would be competitive or non-competitive depending upon how the market is organized and behaves. Thus, a new system of channel organization must be discussed in the context of its market structure with a view to achieving three broad market performance goals. They are concerned with: (1)

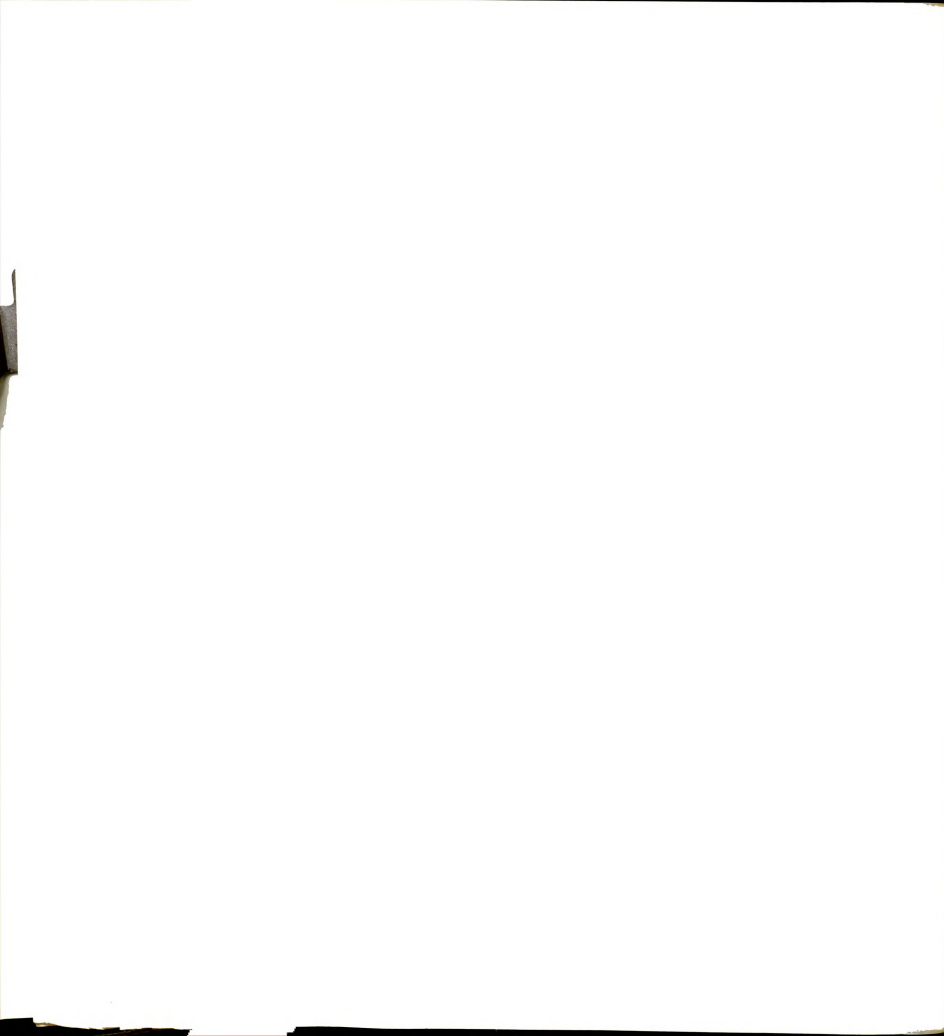


the improvement of resource allocation, (2) stimulation of technological progress, (3) market coordination, and (4) product suitability.⁴⁴

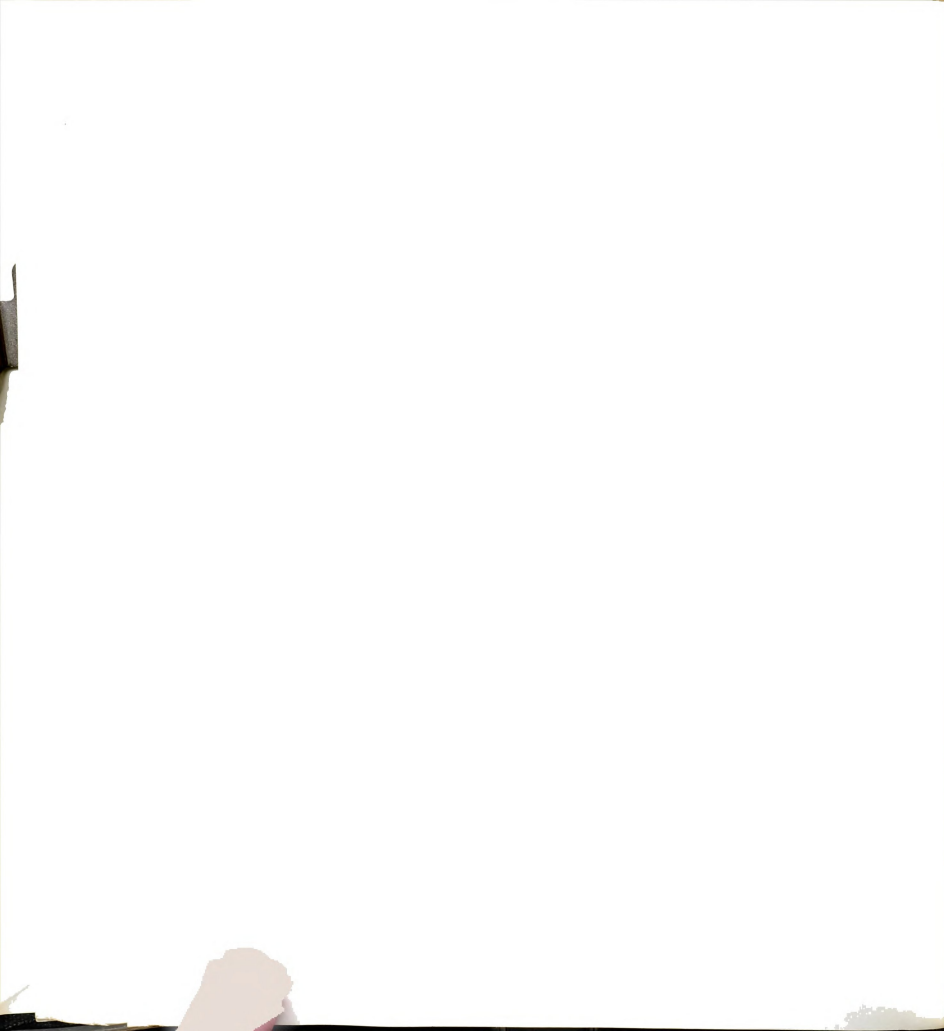
Since the ultimate goal of the government of West Pakistan is to effect a complete transfer of fertilizer channel organization from the public and semi-public corporations to private distribution agencies, a proposed system of distribution thus, must present a Pareto-better solution. Theoretically, the performance of a distribution system is to a great extent dependent upon its structure. Alterations in the structural variables are, therefore, likely to affect the firm conduct and market performance. Under the existing system of distribution, there are only three private agencies which as a whole claim almost 50 percent of the market share. The activity of private enterprise being at a very small level provides a relatively small geographical coverage, marketing service, and consumer choice. With their meager financial resources they are not only uneconomical and inefficient, but also lack adequate resources to build up a viable distribution system, and a firm market strategy to expand their relative and absolute market shares.

The atomistic structure of farm producing units, small size of farms, and low level of rural per capita

⁴⁴Product suitability refers to the improvement of fertilizer quality through grading, standardization, and an improved system of market information flows.

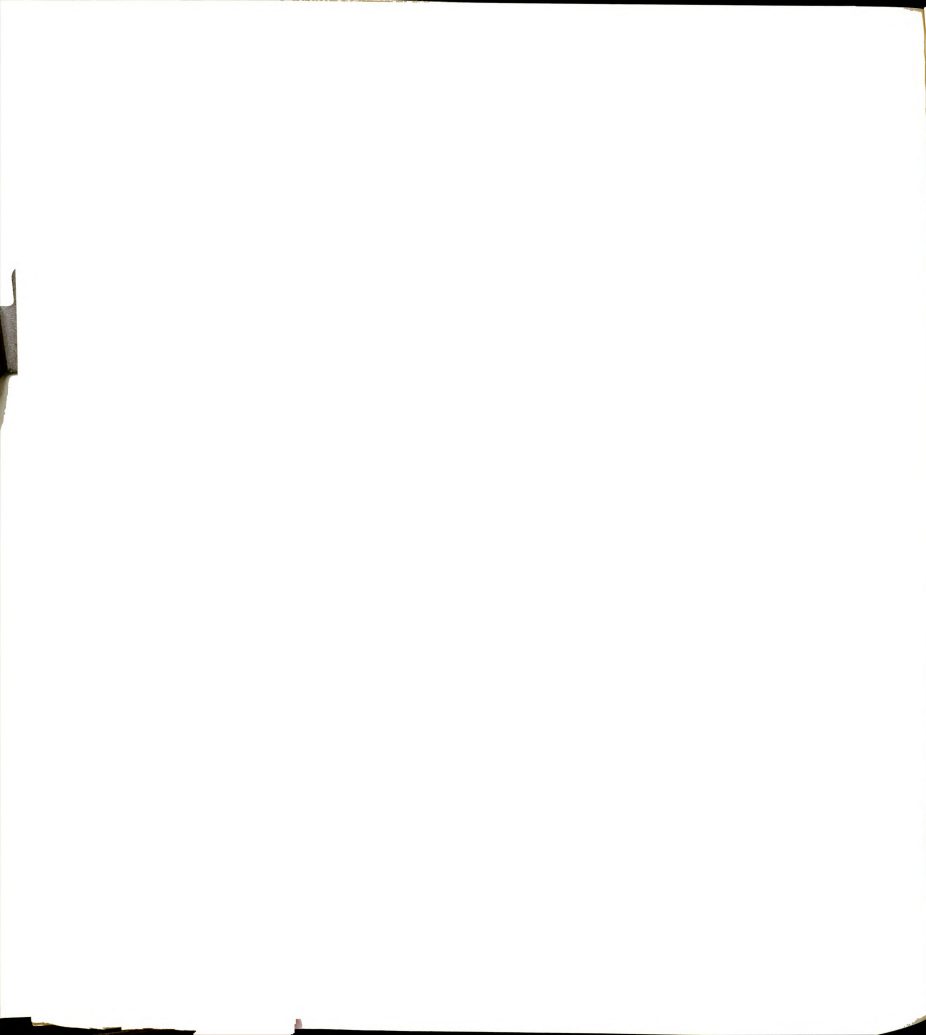


income demand that the fertilizer marketing system be decentralized so as to increase the number of distribution centers. It must maintain a chain of warehouses and retail outlets at strategic points in the rural areas in order to reduce the distance between rural farms to markets and to speed up the delivery system. An expansion in the number, size, and scale of operation of current private unit channels must, therefore, take place if the productivity and efficiency of the existing unit channels is to be improved and is to be made compatible with competitive norms. From the knowledge of economic theory, it can be said that oligopoly is by far the most common and important type of market structure in the agricultural supply and marketing industries. Whereas firms as unit channels in oligopolistic markets often exemplify schizophrenic behavior, as individual firms they are motivated to take the competitive offensive and strengthen their market position at the expense of competitors with no appreciable increase in sales and a loss in net price competition. They may as a group agree in the maximization of their joint profits which would be very much similar to the behavior of a single monopolist. Despite the fact that firms in an oligopoly are motivated to maximize their joint profits, often they are able to do so to a limited extent because of a combination of market restraints. Under such a market situation, the



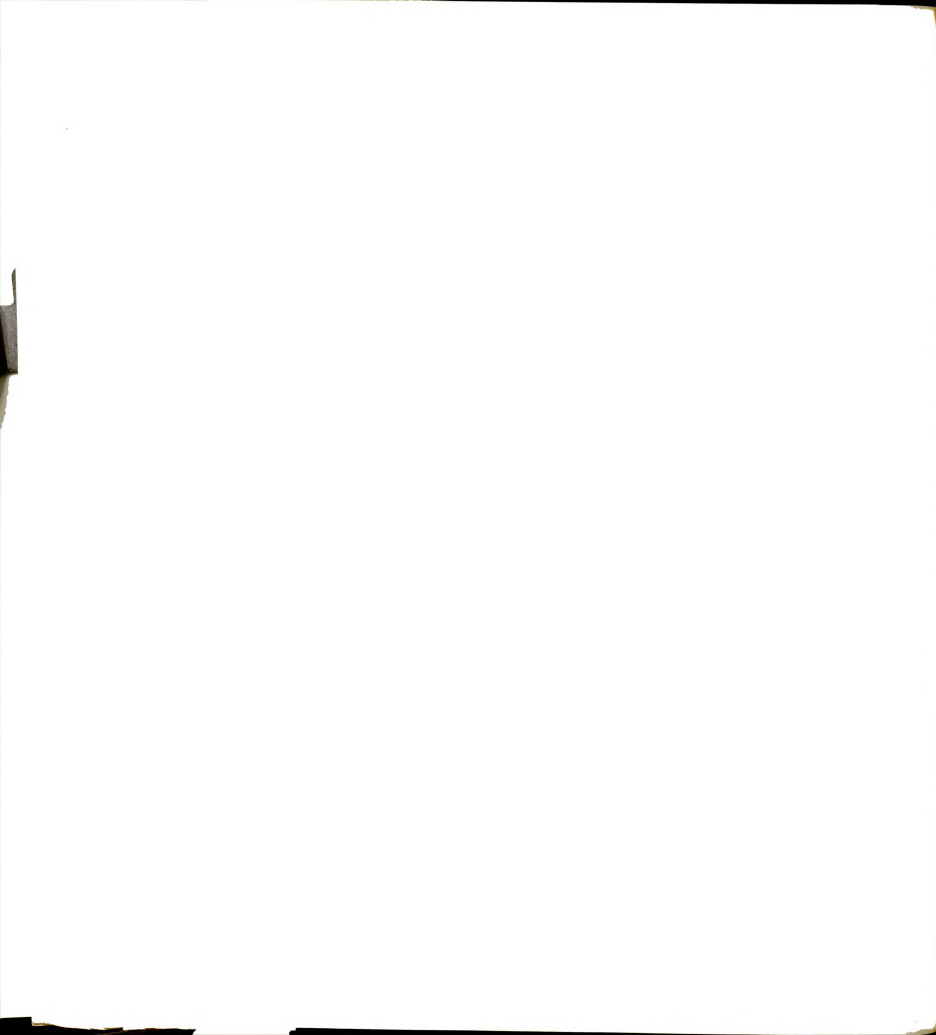
fear of retaliation tends to limit open price competition among firms without involving any direct retaliation; the price cuts, however, tend to be secret and discriminatory with a large number of customers of competitors being often favored.

Since the direct consequence of a monopolistic or oligopolistic market structure most often is the "imperfect competition prices," it may lead to price collusion, joint profit-maximization, and misallocation of resources. Whereas "competitive pricing," based on a large number of sellers is likely to lead to lack of progressiveness, lack of improvement in marketing service, and sales promotion, a horizontal expansion in the number and size of marketing firms in the fertilizer industry must, therefore, take place towards an oligopolistic structure of the market. Vertical expansion is desirable for increasing the local availability of fertilizer at the farm level through a chain of wholesalers, retailers, and sub-agents. As already discussed, the existing system of administrative controls, allotments, quotas, and price controls does not allow for a freer adjustment of the market forces of supply and demand and leads to the elimination of some of the important points of price formation. Thus, the substitution of a fertilizer distribution system which is free from such controls would lead to price formation through exchange mechanisms operating at various levels of the



distribution system resulting in horizontal and inter-type competition among the vertically integrated private distribution channels.

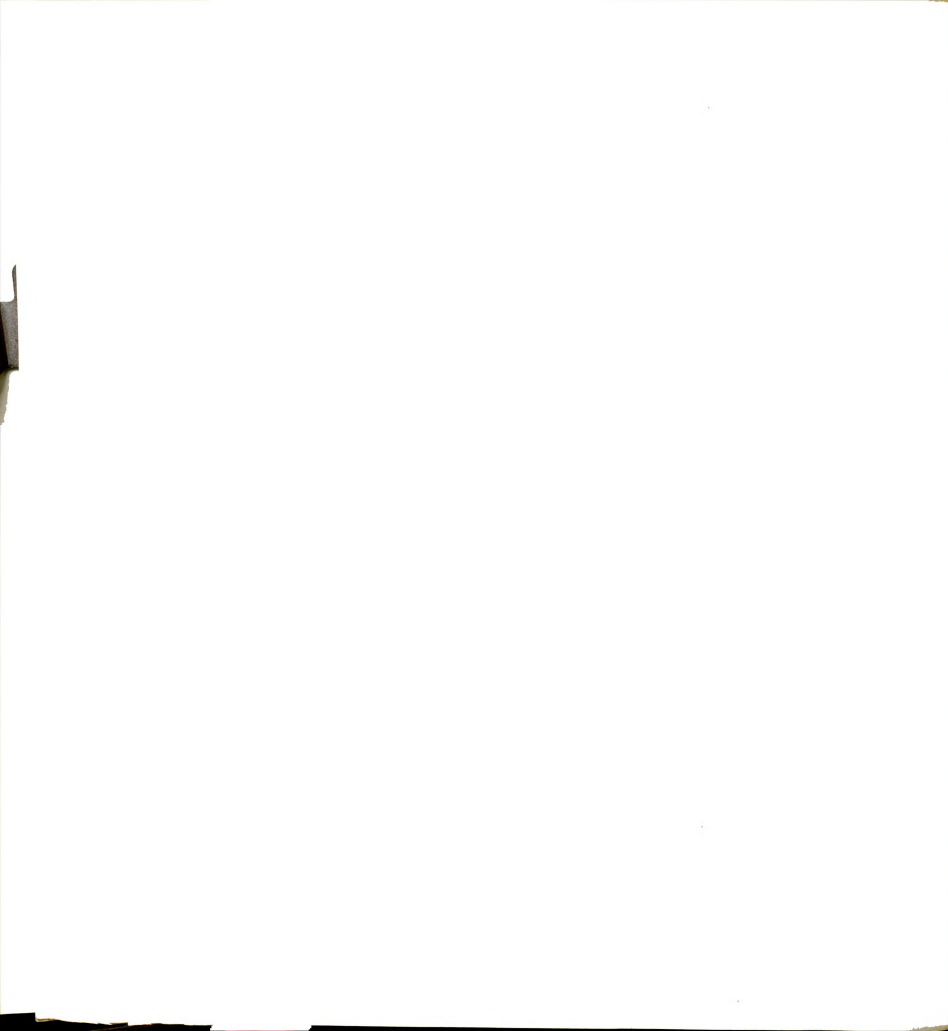
The main objective is to combine various vertically integrated privately-owned distribution agencies in the form of unit fertilizer channels into a single market channel which may involve the economies of size and scale and of merging the various stages of marketing and at the same time to incorporate the benefits of providing better consumer service, lower-cost, and timely delivery of fertilizers. Since the existing state of channel formation is very rudimentary and divided among too many distributors, it is neither economical to supply the needed marketing service at the current size of operation nor does the private distributor have adequate resources. From the economic point of view, the private distributor is not prepared to lock up his high opportunity cost resources in long-term investments involving short-term losses and long-term benefits. In addition, the long-term benefits are neither large enough nor so visible as to attract the needed investments. The private distributor does not have adequate technical know-how for improving the methods of handling, reducing the costs of keeping lower or higher than optimum levels of inventory, managerial efficiency, methods of demand assessment, and measuring the marginal returns from an extra unit of service provided.



Thus, it is supposed to be a privately organized fertilizer channel structure where the government plays the role of a speculator through the maintenance of regular speculative inventories at various strategic points in West Pakistan and thereby keeps the wholesale prices of fertilizer at remunerative and socially desirable levels through the release of fertilizer stocks from time to time. On the supply side, the government must respond to private investor's perception of demand-induced investment opportunities for the production of indigenous fertilizers by timely and adequate allocation of foreign exchange. Fertilizer imports must be scheduled much ahead of time and their magnitude may be determined from the anticipated domestic demand for fertilizers and the need for keeping adequate inventories after deductions from the expected annual indigenous fertilizer production. Since there is an invariable tendency for indigenously produced fertilizers to lag behind the requirements with increments in fertilizer demand being met from an increased level of imports, it would be desirable that in order to save the high opportunity cost resource of foreign exchange no opportunity be spared to engage in import-substitution as soon as fertilizer imports reach the critical minimum size necessary for the initial operations of an economic-sized plant. At present, the existing level of fertilizer imports indicates that the decision to locate a medium-sized nitrogenous fertilizer plant could substitute for

a large volume of fertilizer imports and, therefore, a fixed amount of foreign exchange to finance the capital costs, could substitute for a recurring expenditure of foreign exchange.

One of the flaws in the existing system of fertilizer distribution is the lack of coordination between public-supported sales promotion through fertilizer demonstration plots and private sales effort. Thus, much of the activity of agricultural extension department loses its significance, because of the non-availability of fertilizers in a specific area and also because of the inability of extension workers to demonstrate the higher productivity of fertilizers due to lack of proper dosage, appropriate combination of plant nutrients, and lack of soil testing facilities. It will, therefore, be desirable that each individual distributing agency should maintain its own agronomic service unit as a part of the selling and servicing organization. Since there is a derived demand for soil testing facilities and other auxiliary services like advice on fertilizer application, selection of seeds, and use of pesticides by the fertilizer buyers, a major expansion in the sales volume can be expected. It must maintain an organized and intensively trained team of fertilizer sales personnel who should be able to advise farmers as to how, when, and where to use the fertilizers. They should be equipped with portable soil sampling kits



in order to collect soil samples wherever found necessary and which may be sent for analysis to a central soil testing laboratory and mailed back to farmers. It should, however, be conveniently located to the areas of primary consumption and maintained by an individual distributing agency.

Since most of the fertilizers which are sold in the market at present are unstandardized and non-graded, a government regulated and standardized system of uniform grades of fertilizer must be introduced in order to ease the process of consumer selection and producer specification. The system of grading is frequently defined as: ". . . a process of segmenting a highly heterogenous supply of a commodity into smaller more homogenous groupings which are more nearly substitutable for one another than with other units."⁴⁵

The two economic effects that may accrue from such a system of grading are: (1) reductions in marketing costs and operational inefficiency, and (2) improvements in pricing accuracy.

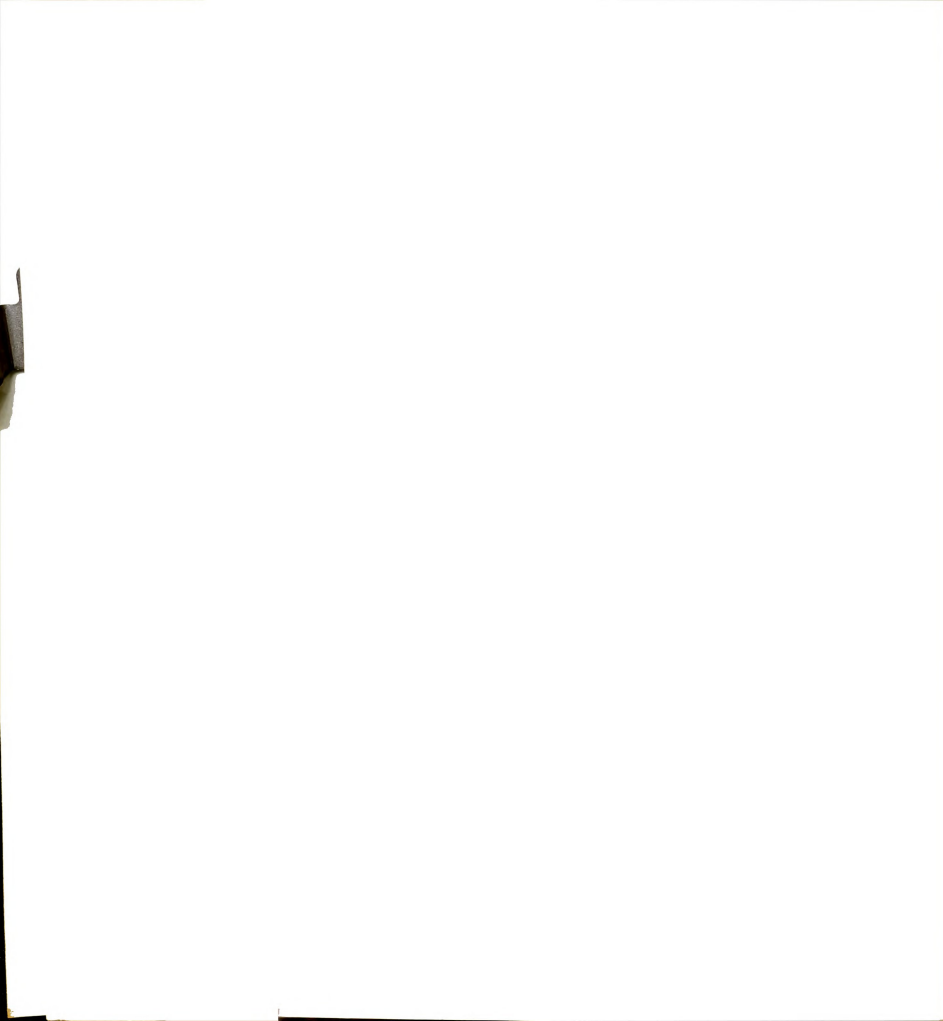
The beneficial effects from such operational efficiency will follow from:

⁴⁵W. F. Williams and T. T. Stout, Economics of the Livestock-Meat Industry (New York: Macmillan Co., 1969), pp. 445-89.

1. Increasing the extent of buying and selling by description.
2. Eliminating time and expense associated with arguments regarding quality.
3. Encouragement of specialization among suppliers by function, type of product handled, and type of outlet.
4. Reduction of pressure among suppliers for large expenditures on competitive brand advertising.
5. Increasing the emphasis on technological innovations, improving marketing practices, and other means of reducing costs through intensifying competition on price basis.

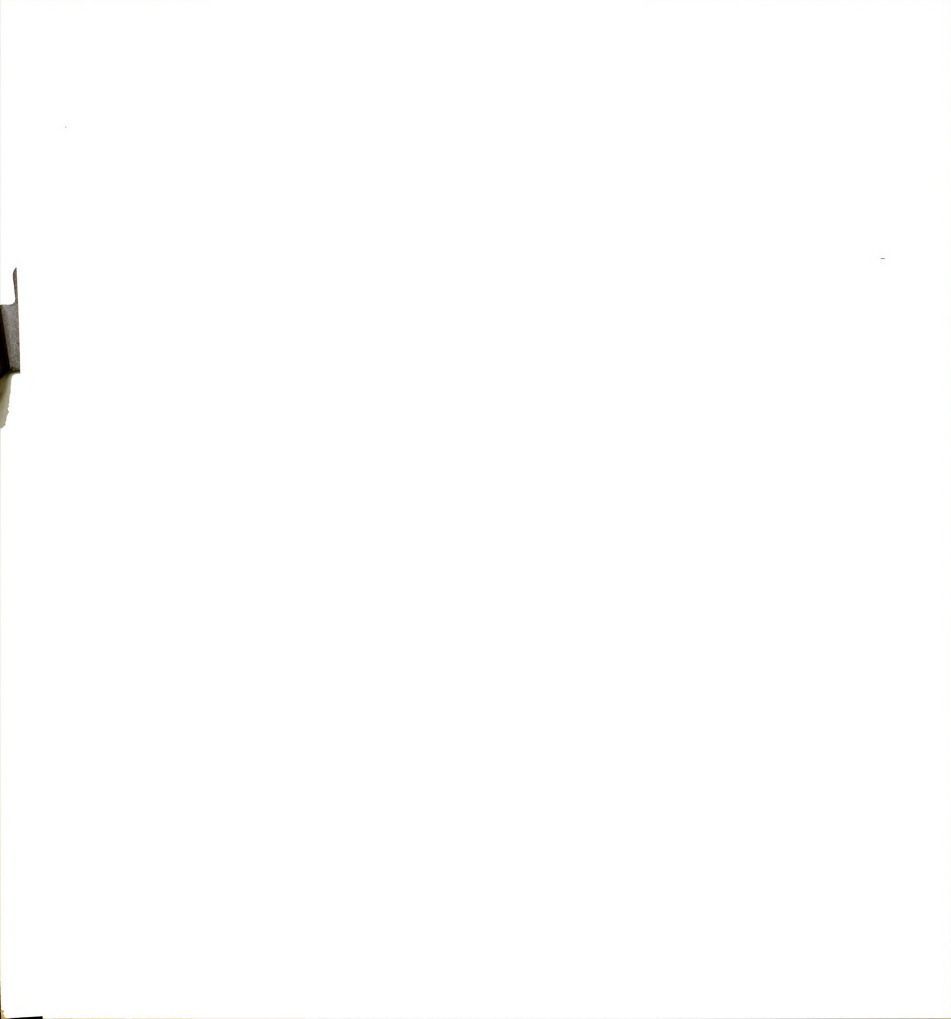
The improvements in pricing accuracy may, however, be attained through:

1. The provision of a universal and generally accepted language by which differences in attributes of quality and level of nutrients can be interpreted by consumers and trade alike.
2. Increase of accuracy in the process of price formation through improved knowledge and increase in intensity of competition on price basis.



3. An increase or improvement in the efficiency with which desires and preferences of consumers are transmitted through the marketing system.

A system of market information dissemination would be necessary to improve the process of decision-making of the farm-buyer concerning the quantity. Adequate, accurate, and timely information can lead to effective production and marketing decisions and competitive price determination. Even though the overhead costs of providing such services may be higher in the short run, in the long 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 to the farmers, and feedback to the producers, exists except for the prices which are also fixed. A system of market news dissemination making use of local newspapers, a farm journal, and radio broadcasts must be brought to bear upon the generation of information flows by the fertilizer distributing agencies. Information concerning detailed specification of fertilizer dosage per acre in various combinations of plant nutrients for various crops must be provided to the farmers to facilitate the process of consumer selection and rational choice. That irrational choice of fertilizer grades by farmers can give rise to social costs arising from less rather than more economical sources of plant nutrients is



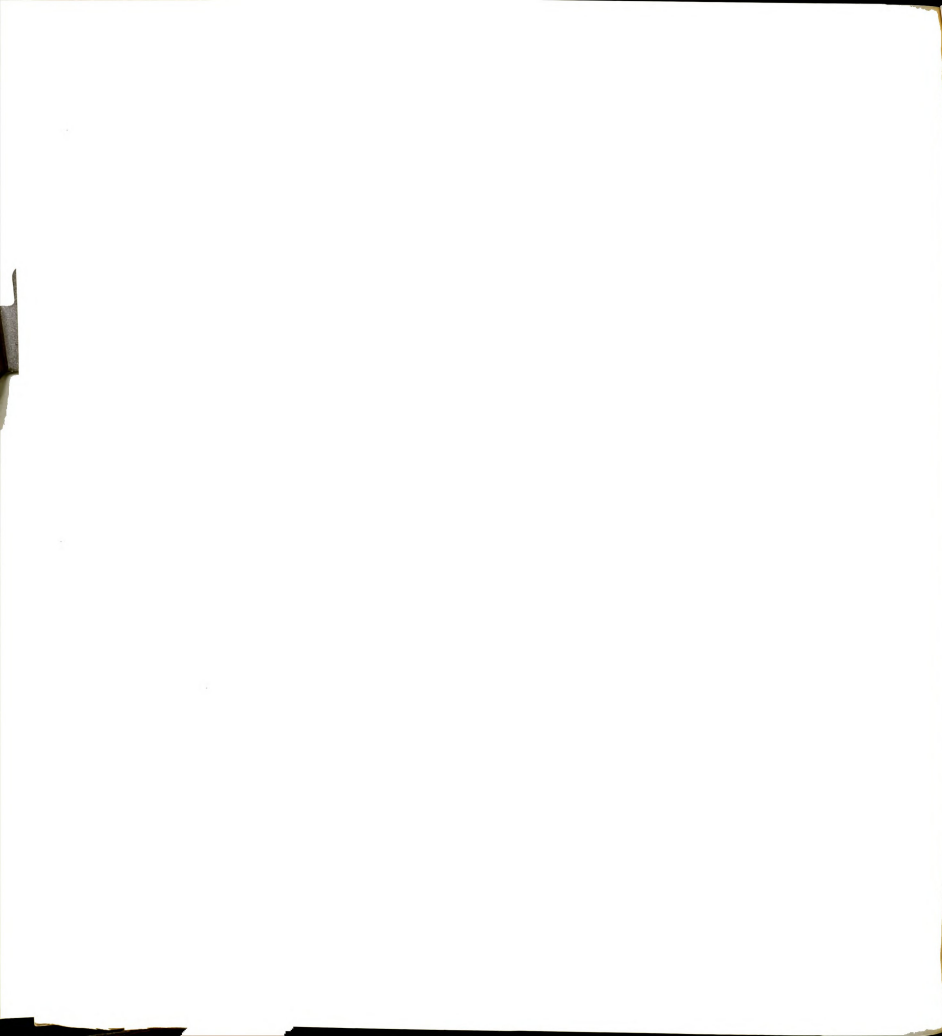
indicated by the fact that in the United States such costs amounted to \$61 million or 5-10 percent of the nation's total fertilizer bill in 1949.⁴⁶ Similar calculations made by Zvi Griliches put the "costs of imperfect knowledge" at \$20 million in 1954 and \$44.6 million in 1958.⁴⁷ In other words, it must be clearly demonstrated to the farmers that two bags of fertilizer with 50 percent of nutrient content in each acre equal to one bag containing 100 percent nutrient content in the same combination.

An additional development which must constitute a vital link in the system of fertilizer distribution is the provision of fertilizer mixing facilities. The need for fertilizer mixtures has assumed greater importance because of the greater realization by the farmers concerning the use of balanced doses of fertilizer. Consequently, the consumption ratio of nitrogenous to phosphatic fertilizers ($N:P_2O_5$) which was 1:6 in 1967-68 has decreased to 1:4 in 1969-70.⁴⁸ Fertilizer mixtures also are likely to contain an improved ratio of potash besides nitrogen and phosphates, because of the potassium deficiency in some

⁴⁶Jesse W. Markham, The Fertilizer Industry--Study of the Imperfect Market (Nashville: Vanderbilt University Press, 1958).

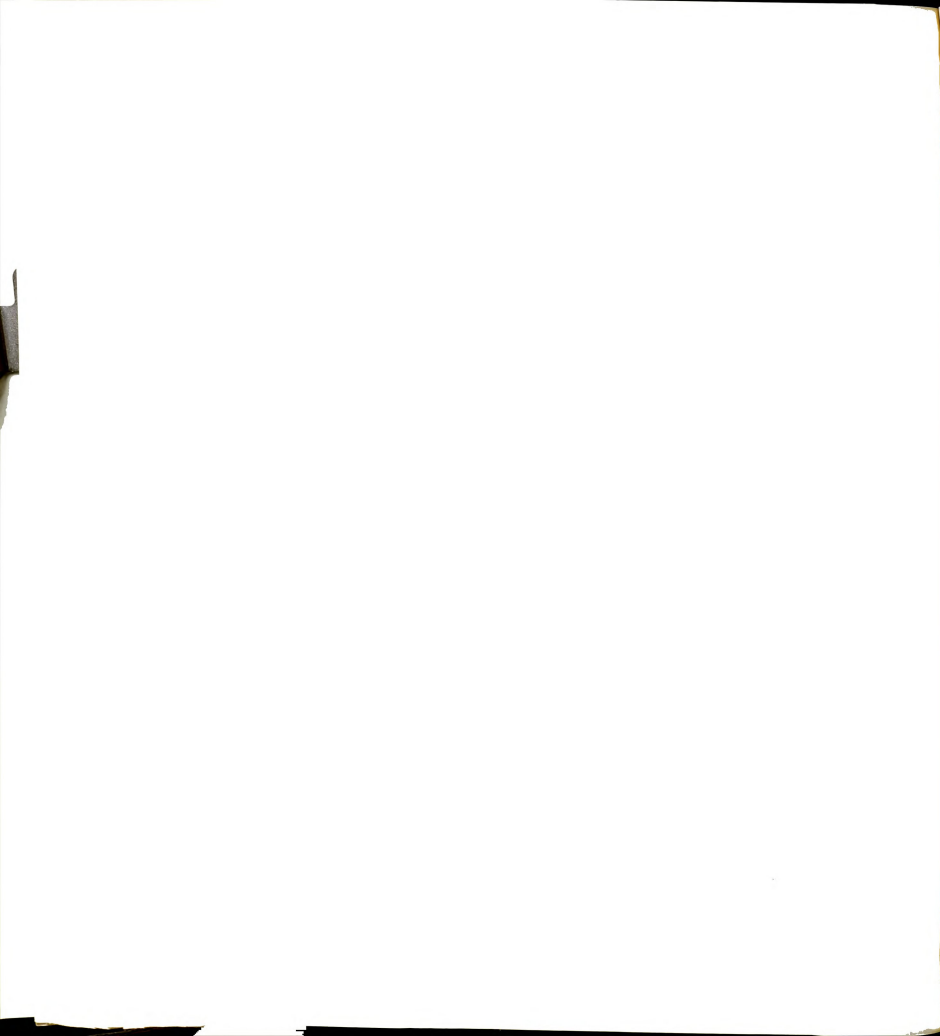
⁴⁷J. R. Moore and Richard G. Walsh, Market Structure of Agricultural Industries (Iowa City: Iowa State University Press, 1966).

⁴⁸An unpublished memo issued by the West Pakistan Agricultural Development Corporation, Lahore, 1969, pp. 4-10.



areas of the country. Fertilizer mixing plants must be located near the areas of primary consumption so that the process of assortment of particular fertilizer nutrients in accordance with farmer needs can be facilitated. From the long-run point of view, it is desirable to lay emphasis on the provision of centralized fertilizer mixing facilities with considerable emphasis on the economies of size. As a preventive measure against fertilizer adulteration, the government should legally prohibit malpractices of hoarding, dishonesty in dealings, and impurity of fertilizer mixtures.

Although there are some institutional and non-institutional sources of agricultural credit in West Pakistan, the credit requirements of farmers are much higher than supply. There is an acute need for short-term supervised credit to finance the purchase of farm inputs. It is, therefore, recommended that each of the proposed fertilizer distribution agencies should maintain a vertically, integrated credit supply line with the objective of extending short-term fertilizer loans to farmers requiring a low level of security. The system of loan recoveries may be simplified by the acceptance of farm produce after the harvest and writing off the loans by their sale proceeds. With credit facilities available at each retail outlet, the system of supervised credit would require a detailed account of loans

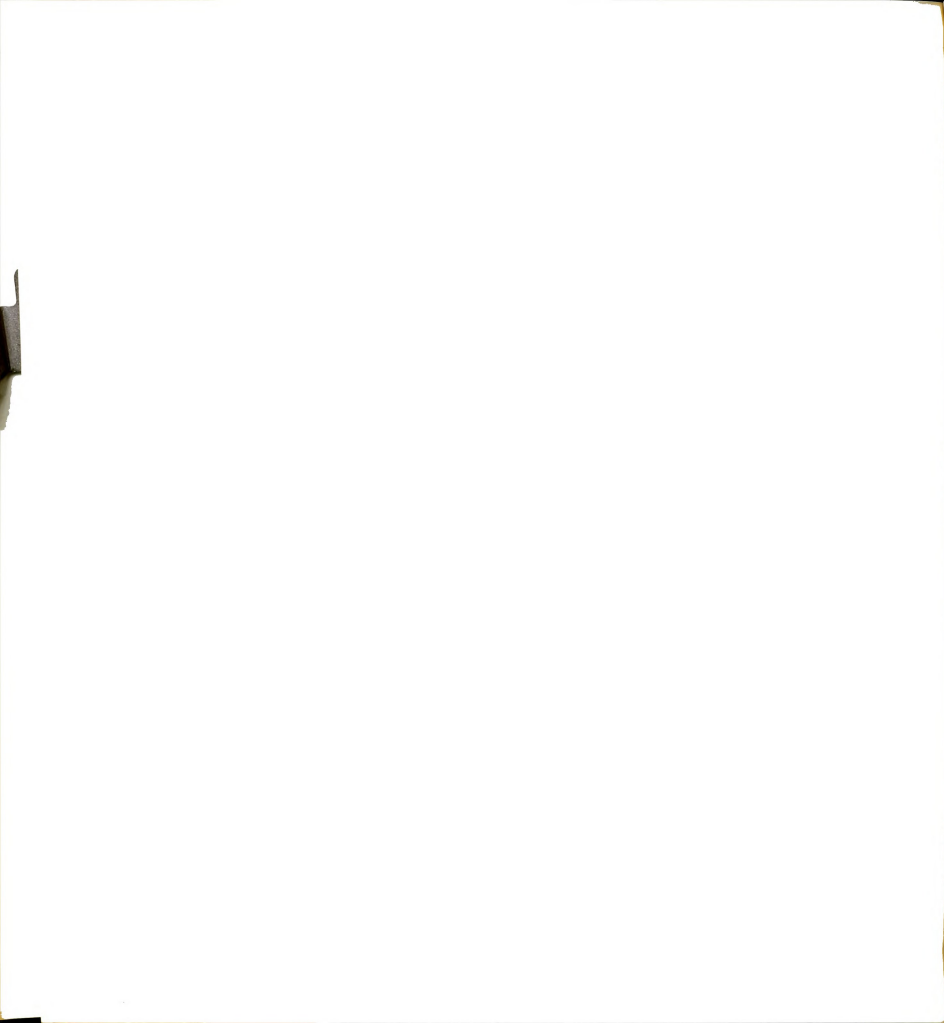


and recoveries for each farmer. Since the retailers, and sometimes wholesalers, lack adequate financial resources to finance the inventories required to meet emergency and peak season needs, a system of inventory financing must be part of the loan program for each fertilizer unit channel.

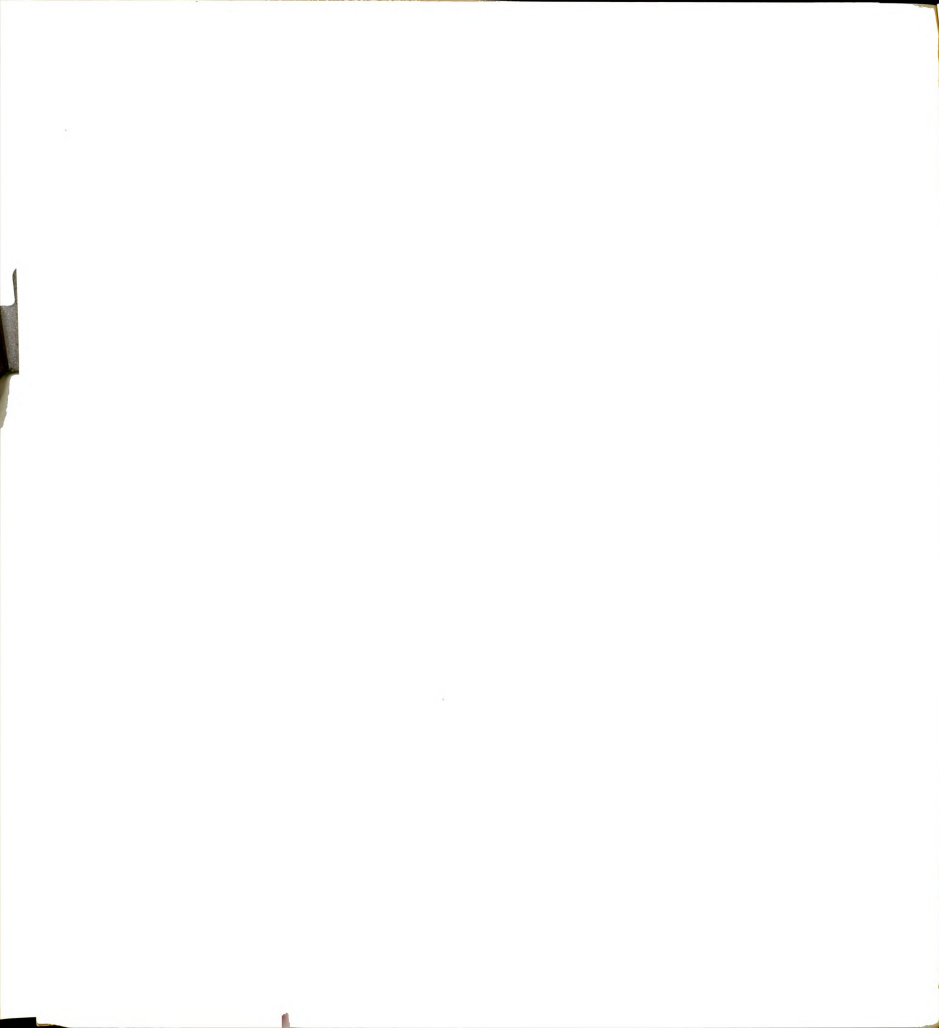
Conclusions

A critical evaluation of the history of fertilizer distribution on the basis of ownership and control indicated that the fertilizer market channel has been characterized by considerable organizational and market instability. The operations of fertilizer market channel were analyzed on the basis of the following criteria: (1) operation of exchange mechanisms at various levels of the vertical segment of fertilizer channel, (2) progressiveness, (3) channel efficiency, and (4) channel coordination.

It was found that the fertilizer market channel was not progressive enough to dynamically adjust to the rapidly expanding demand for fertilizer. Nor was it efficient enough to maximize the output-input ratio. The past experience has indicated that the substitution of private enterprise for public enterprise would be necessary in order to incorporate the elements of profit-motivation as well as to attain a distribution system



free from administrative controls. An alternative system of channel organization was proposed to fulfill the goals of technical advance, efficiency, and market coordination. Since the government cannot undertake all these reforms in a package form, in the interests of maximum effectiveness of public policy, it would be necessary to effect some major organizational changes and provide such marketing services which are complementary.



CHAPTER V

PHYSICAL DISTRIBUTION SYSTEM

Introduction

The purpose of this chapter is to present a regional system of fertilizer distribution for West Pakistan in such a way that it outlines the actual movement of fertilizers. Its primary objective is to simplify a complex network of distribution outlets spread over the vast geographical expanse of West Pakistan by plotting up major fertilizer consuming areas into five distinct regions and thus to reduce the difficulties of fertilizer movement over longer distances through an already overburdened system of railroad transport. This system of regional distribution aims at reducing the marketing costs by inducing faster delivery and shorter fertilizer haulage as well as minimizing the costs arising from fertilizer caking and in-transit fertilizer losses. Since the major constraint in the physical movement of fertilizer is the available transportation capacity, the plan is to create a number of self-sufficient regions in order to reduce the costs of inter-regional and intermodal fertilizer shipment by organizing a chain of fertilizer producing factories to

meet the fertilizer needs of their respective regions. As a part of the demand for fertilizer is met by domestic production and the rest by fertilizer imports, a strategy has to be designed as to where the imported supplies can be directed at least cost with the long-run aim of import substitution. The research procedure is to make an assessment of the production potential of various fertilizer factories and projection of fertilizer requirements of various regions of West Pakistan up to 1974-75 and to conduct an analysis of the attendant requirements of warehousing and transportation.

The physical distribution system is, as a matter of fact, supposed to constitute a vital link in the vertically integrated and workably competitive distribution system of the preceding chapter. It is an aggregation of the physical movement of fertilizer so as to trace out and facilitate the process of effective delivery and local availability to the farmers. Under this system, no individual fertilizer distribution agency is supposed to enjoy a monopoly franchise over any single marketing region, but the economic activities of each agency in various regions are overlapping.

Regional Pattern of Fertilizer Consumption

West Pakistan can be divided into twelve administrative divisions for the sake of convenience involving a varied range of soil types, topography, crop sequences,



and irrigation systems. They differ not only in their socio-economic and cultural characteristics, but also the level of farm income, pattern of farm practices, rate of input use, and level of farm productivity. The intensity and level of fertilizer use fluctuates within a wide range, from less than one pound per acre in Quetta and Kalat divisions to 78 pounds per acre in Multan division. Thus, the problem of bringing fertilizers within the effective reach of farmers varies from division to division depending upon their cultivated acreage, crops sown, level and intensity of fertilizer consumption. The twelve administrative divisions of West Pakistan have been classified into five ecologically homogeneous regions. The various divisions which fall in the domain of a particular region are given below:

Region 1:

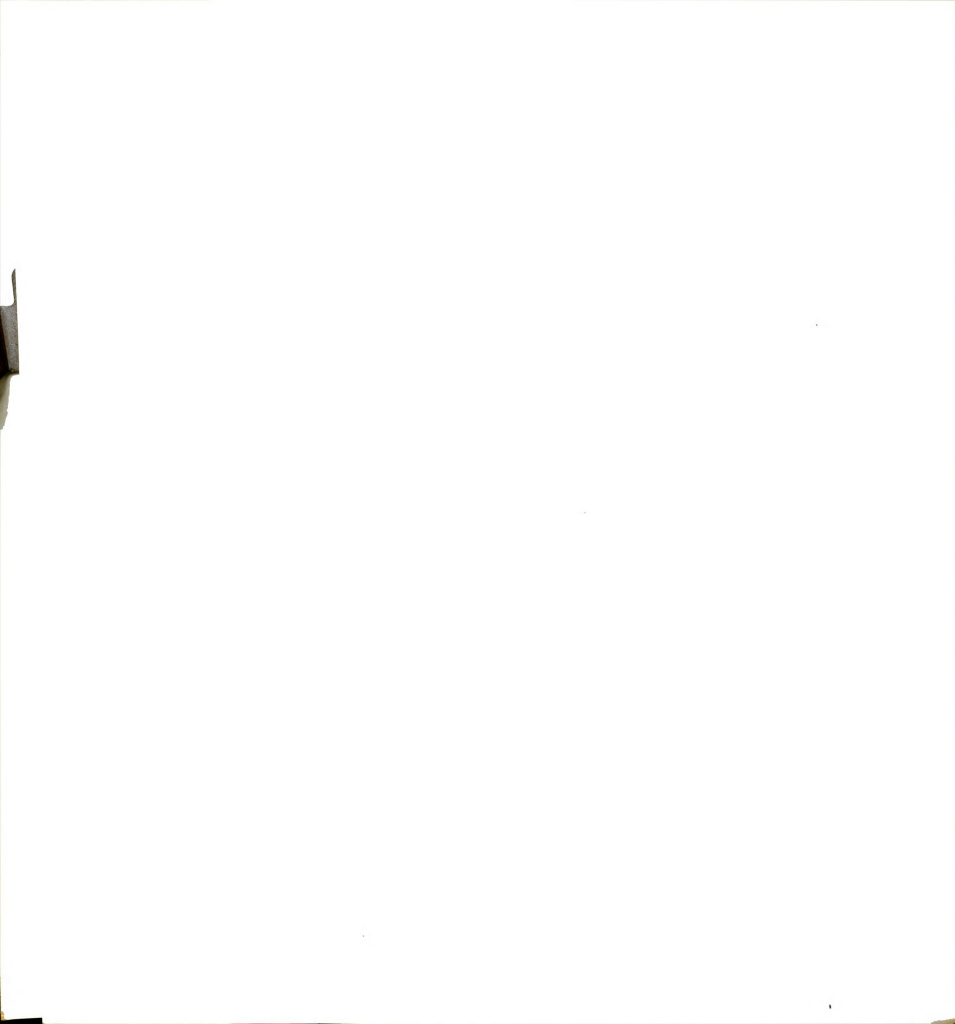
1. Peshawar division
2. D. I. Khan division
3. Rawalpindi division

Region 2:

1. Lahore division
2. Sargodha division

Region 3:

1. Multan division
2. Bahawalpur division



Region 4:

1. Khairpur division
2. Hyderabad division
3. Karachi division

Region 5:

1. Quetta division
2. Kalat division

Since there exists a pseudo-complementarity between a minimum level of water supply and fertilizer use in the climatically arid zone of West Pakistan, relatively greater fertilizer use would be expected in the regions where irrigation water supply tends to be greater. It is assumed, however, that there will be at least partial adoption of new crop varieties on major portions of irrigated agricultural land with a declining use of traditional indigenous crop varieties. Fertilizer demand projections for each of these regions on the basis of an appropriate dose per acre were made up to 1974-75 as indicated in Table 5.1. A comparison of the regional increase in the consumption of fertilizer between 1969-70 and 1974-75 indicates that the rate of growth in fertilizer use in Region 1 is likely to be the highest. The major increase in the demand for fertilizer in West Pakistan as a whole is expected to arise from the adoption of new high-yielding and fertilizer responsive varieties of wheat, rice and cotton, and greater availability of complementary inputs

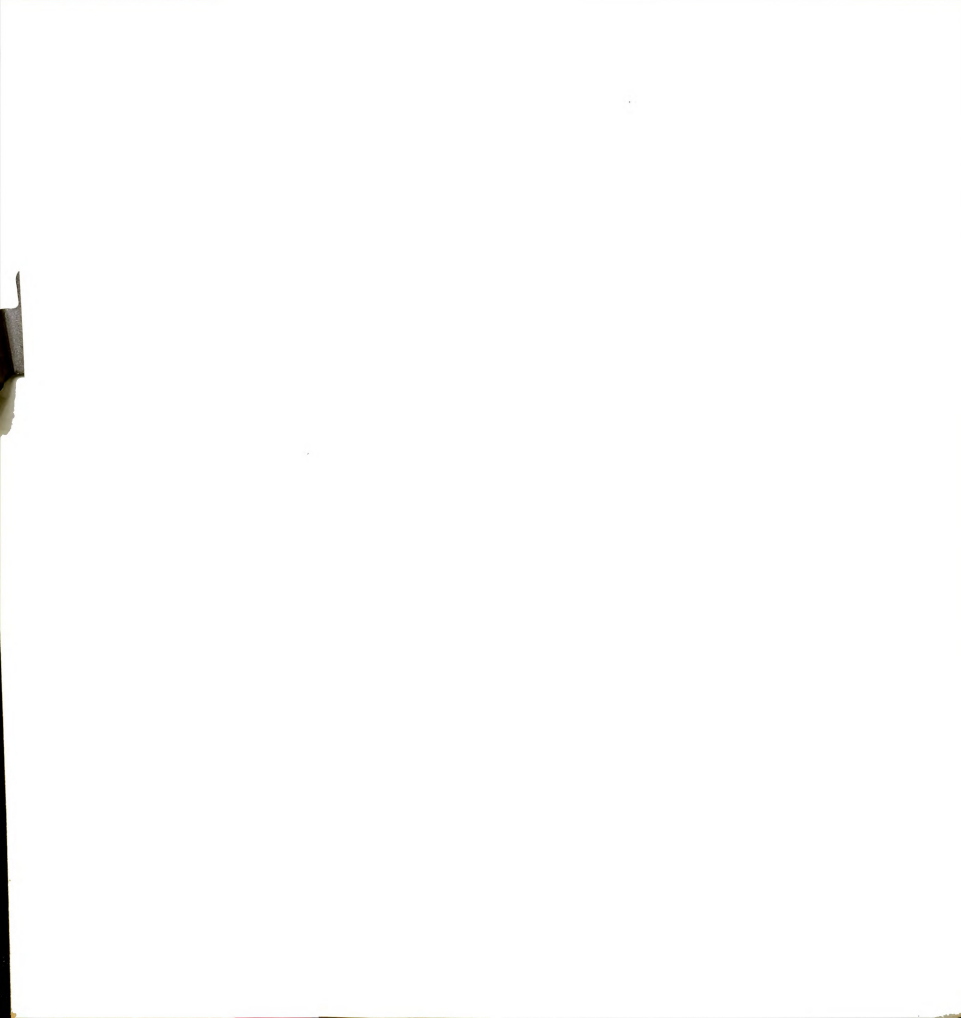




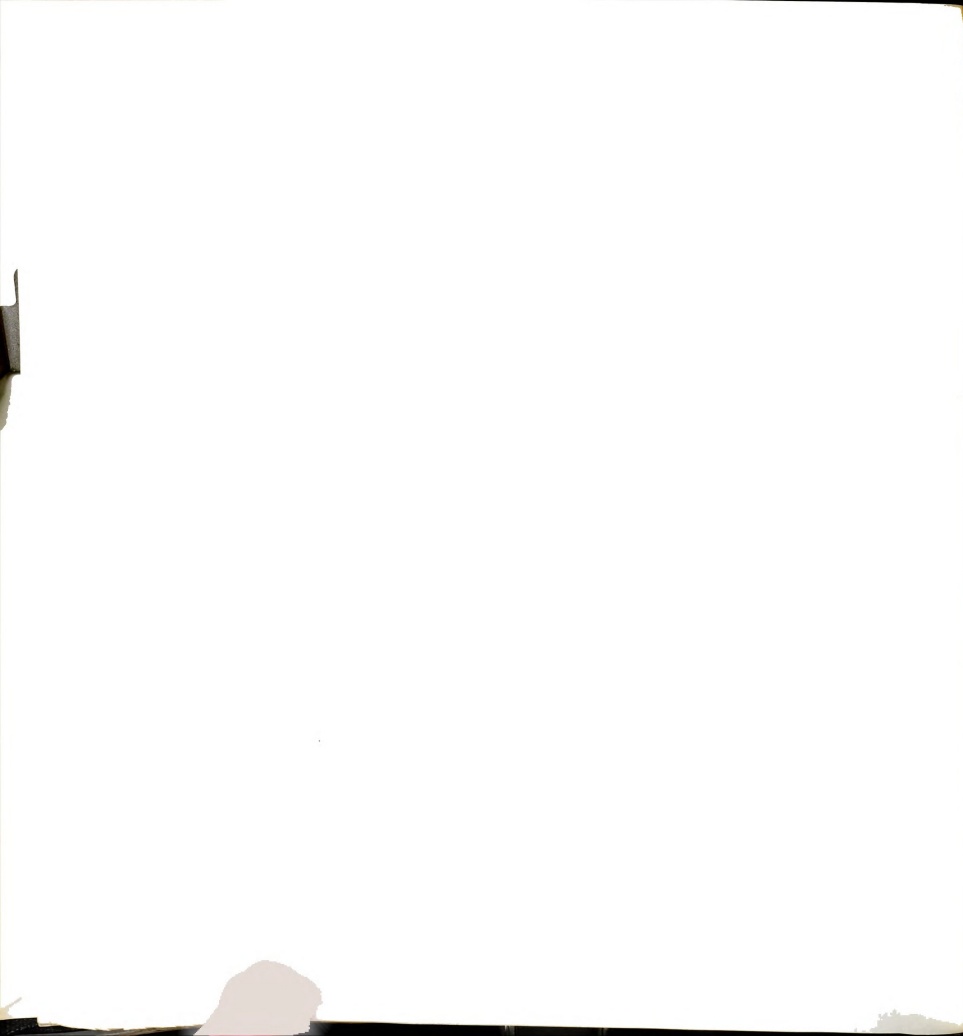
Figure 5.1. Various Fertilizer Regions of West Pakistan.



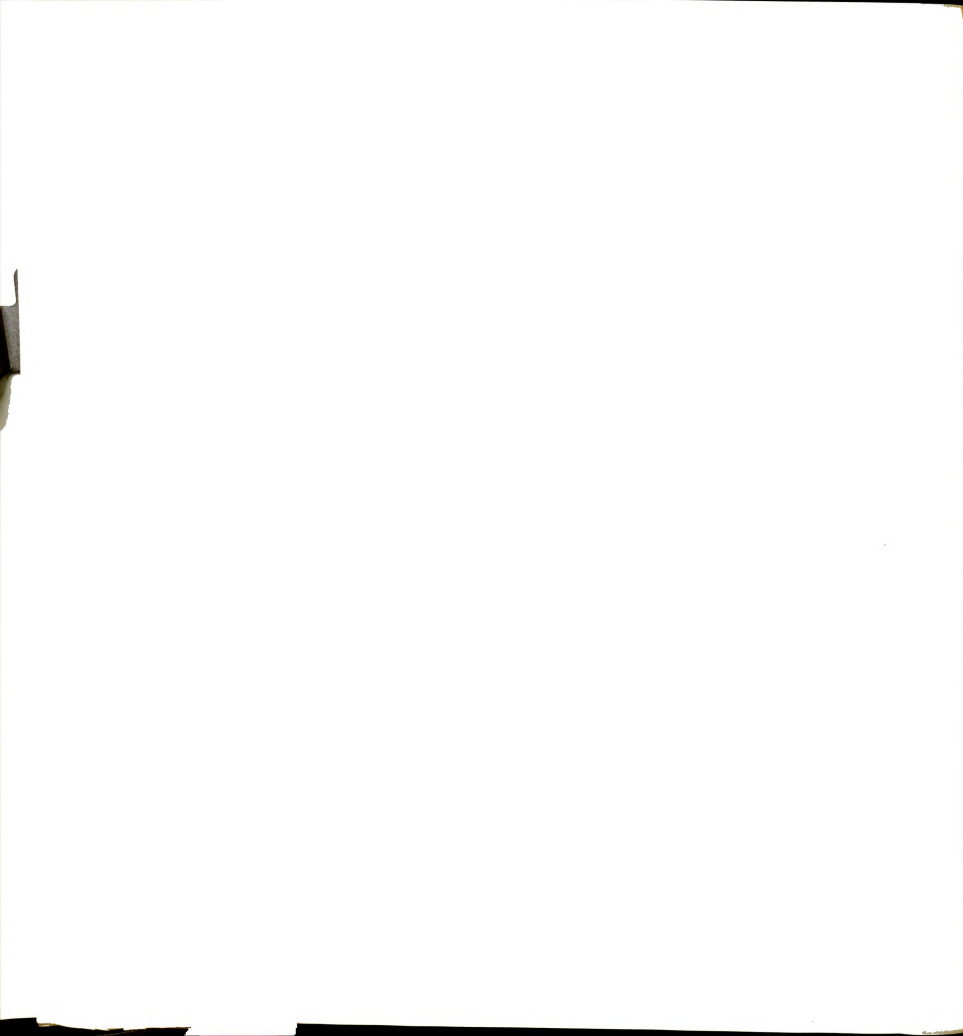
TABLE 5.1. Comparative Regional Demand Projections for Fertilizer in West Pakistan (nutrient tons).

Regions	Fertilizer Consumption Forecast 1969-70 N-P-K	Fertilizer Projections 1974-75			Fertilizer Projections 1974-75 N-P-K	Percentage Increase in Demand for Fertilizer
		N	P	K		
Region 1	10,000	80,170	30,170	13,000	123,340	1133.00
Region 2	120,000	171,960	69,150	12,000	253,100	110.95
Region 3	130,000	150,000	60,910	12,000	222,910	71.97
Region 4	90,000	126,810	50,890	11,000	188,700	109.67
Region 5	5,000	7,480	2,890	2,000	12,370	147.40

Source: Data was obtained from the statistical tables published by the Planning and Development Department, Government of West Pakistan, Lahore.



as well as improved economic and agricultural policies. An extremely disproportionate increase in the projected demand for fertilizer in Region 1 is due to the expectation of a significant increase in cropped acreage of wheat and sugarcane. Available statistics indicate that these two major crops accounted for more than 50 percent of fertilizer used for various crops by the farmers during the second five year plan. Greater use of fertilizer in Regions 2 and 3 is expected to arise from greater diversity and intensity of cropping as well as from a higher rate of adoption of new varieties, increased private tube well development, and relatively higher propensity of the farmers to adopt innovations. In Region 4 fertilizer use is likely to increase progressively as new farm practices take root and "fertilizer consciousness" of the farmers increases. Demand for fertilizer in Region 5 is lower because of the vast amount of barren submountainous and desert land with an extremely low percentage of cropped acreage. Scarcity of irrigation water and lack of modern farm practices do not permit fertilizer use beyond small doses. Thus the absolute as well as relative demand for fertilizer in this region is extremely small.

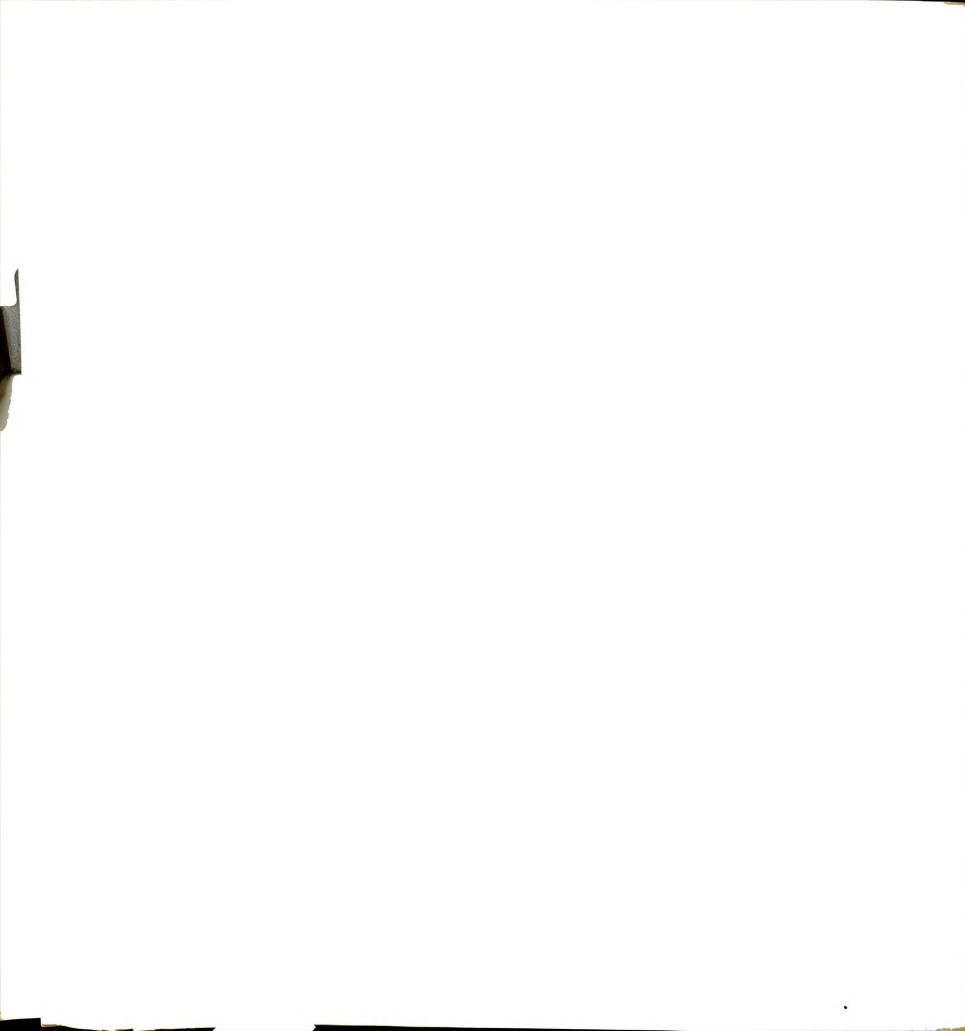


Strategy of Fertilizer Distribution

The process of distribution essentially involves the transfer of fertilizer from given supply points to designated demand points at the least possible cost. Since the currently operating system of fertilizer distribution does not involve the delimitation of marketing radius to smaller distances confined within the already specified fertilizer regions, the marketing radius of any single fertilizer plant located at any strategic place becomes the entire breadth and length of West Pakistan. A major flaw of this system is the relatively high ratio of marketing costs to the per unit production cost of fertilizer. In addition, a broader fertilizer coverage of the farming areas leads to lack of intensification of distribution activity in a particular agricultural area leading to an unsatisfied pent-up demand and sub-optimum use of fertilizers by the farmers.

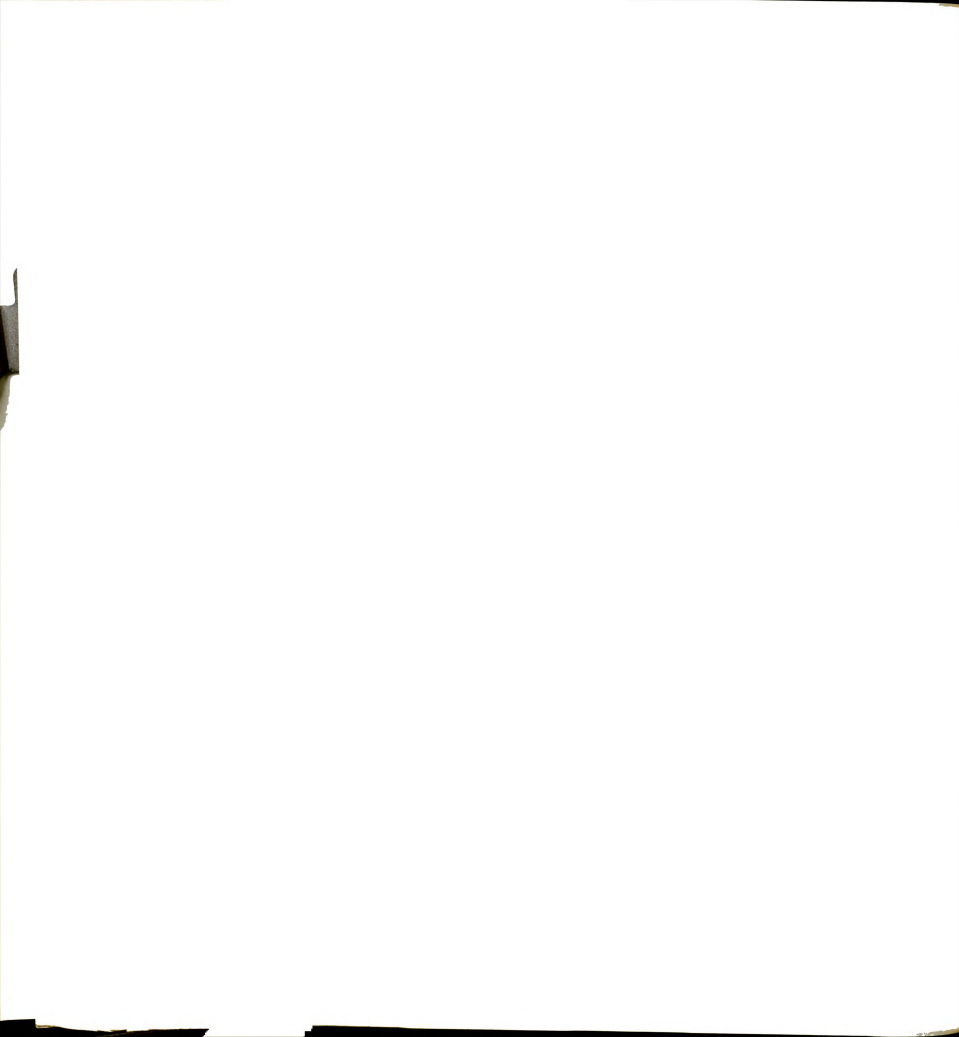
The new scheme of fertilizer distribution envisages the intensification of distribution activity at the micro level and the reduction of inter-regional shipment costs except, of course, in cases when the disequilibriums in the supply and demand for fertilizer lead to the development of surpluses or deficits in various types of plant nutrients in certain regions.

Any strategy for fertilizer distribution in West Pakistan would have to be designed in accordance with the



source of fertilizer supply. At present there exist two major sources of fertilizer supply: (1) imported fertilizers, and (2) indigenous production.

Since imported fertilizers must be channelled through the single seaport located in the southwestern region of West Pakistan, priority in their distribution must be given to the regions which lie in the immediate nearness of the port. The economic justification of this policy is dictated by the fact that the lead time required to replenish the inventories and transportation costs of imported fertilizers progressively rise, as we move farther away to the northern part of West Pakistan. Possibilities of fertilizer losses and pilferage in the movement of fertilizers over longer distances especially to Region 1 are greater because of the numerous rail stoppages and preference of passenger trains over freight trains, as a matter of public policy. Long haulage of such a bulky and low-value commodity as fertilizer would not be feasible, because of the low rate of expansion of railway handling capacity in response to the growing volume of internal and external trade in general, and an exceedingly low ratio of railway handling capacity that is allocated for the transportation of fertilizers. The possibilities of increasing the freight handling capacity of the railway through a multiple train system are ruled out because of the existence of a single railway track which connects Peshawar to Karachi. Alternatively, the pattern of railway



and truck rate structure indicates that the latter can be used only for short hauls. The costs of transporting fertilizers to the farthest areas of Peshawar division tend to be greater because of the likelihood of diseconomies arising from backhauling costs. Thus the primary objective of the official policy of fertilizer import-substitution must be to give priority in the location of fertilizer plants in those areas where the rate of growth and volume of consumption is relatively higher. Under this scheme of fertilizer distribution it is assumed, however, that the constraint of limited transportation capacity can be considerably relaxed through the shipment of fertilizer raw materials to designated grouping points where the plants are located, instead of channelling the imported fertilizers through a complex network of arterial routes. The data in Table 5.1 indicates that the rate of increase in the demand for fertilizer in Regions 1, 2, and 3 shows that preference for the development of fertilizer production capacity should be given to these regions. An assessment of the indigenous fertilizer production potential by the year 1974-75 and areas of deficits and surpluses can be made from Table 5.2.

The supply and demand prospects for fertilizer during the year 1974-75 show that in spite of the existence of indigenous fertilizer producing plants in Regions 2 and 3, there is likely to occur an overall

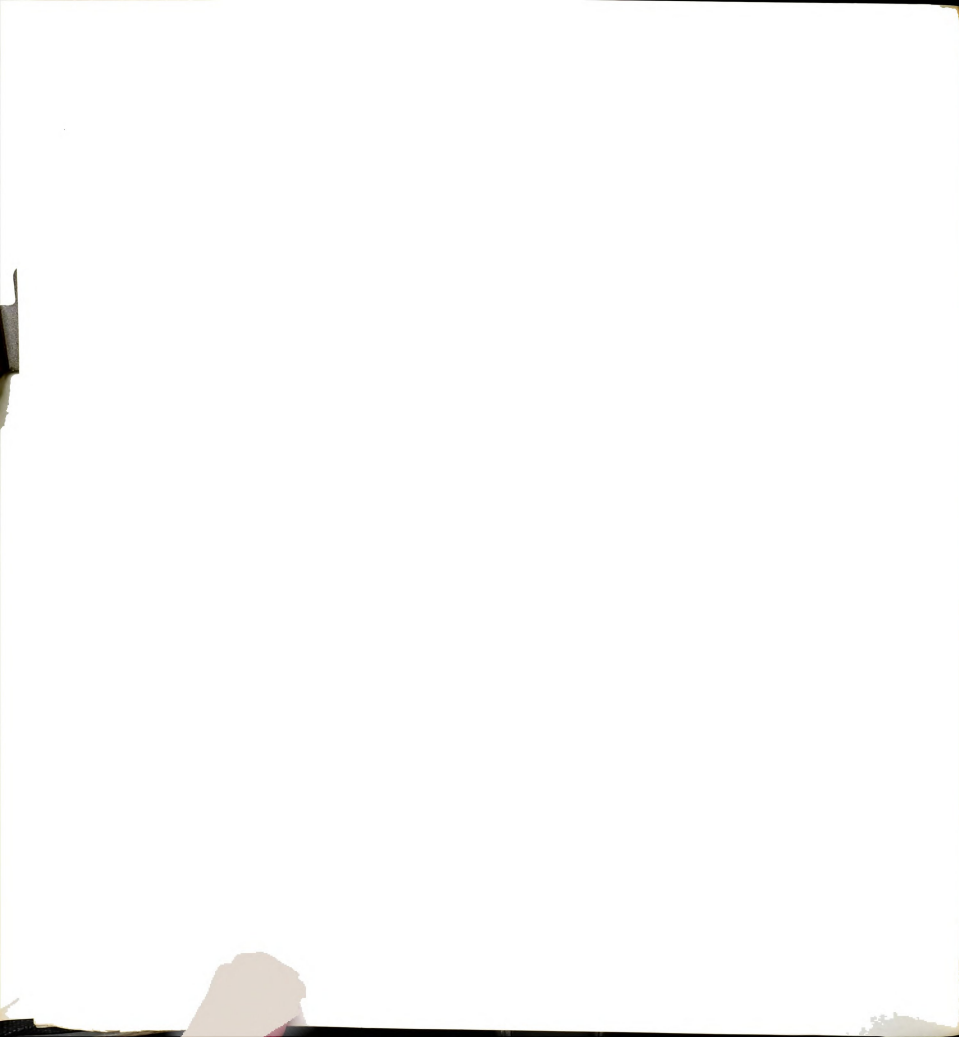
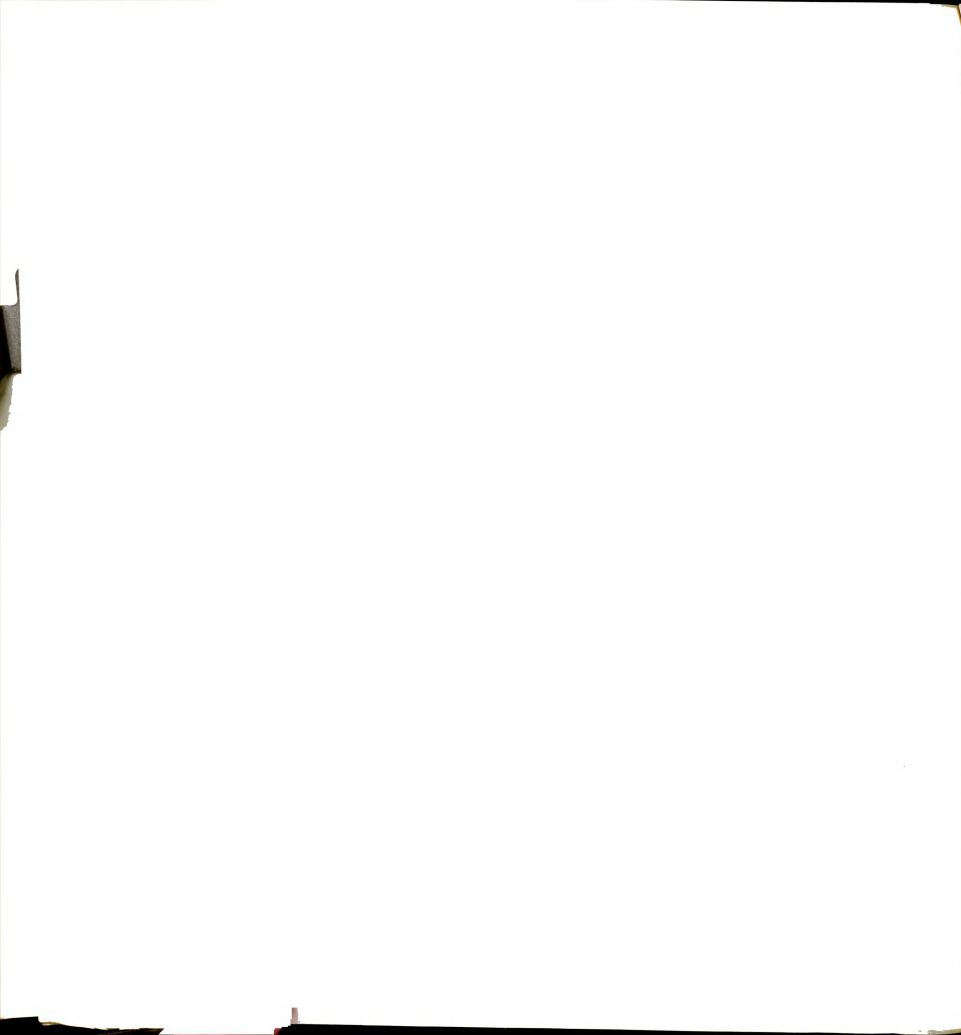


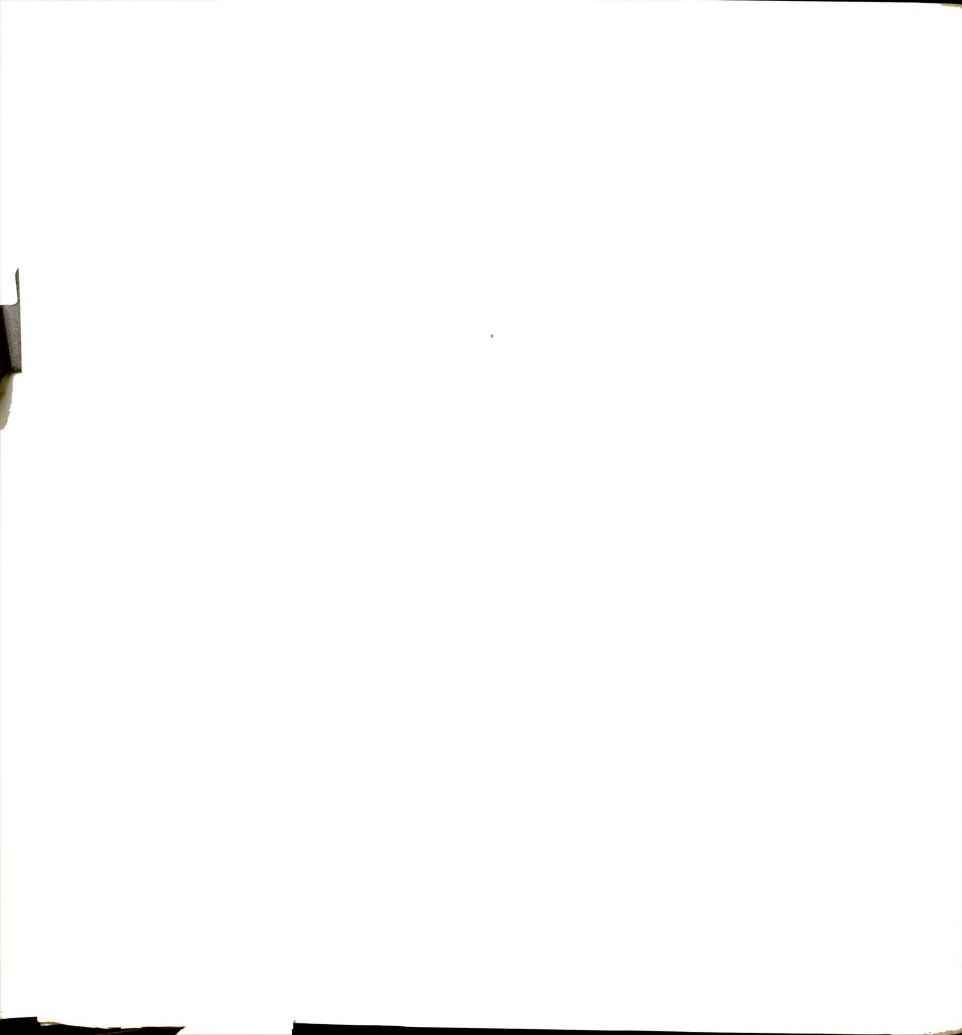
TABLE 5.2. Regional Pattern of Fertilizer Supply in 1974-75 (nutrient tons).

Regions	Production of Indigenous Fertilizers			Short-Falls in Fertilizer Supply Based on Demand in 1974-75			Total Short-Fall
	N	P		N	P	K	
Region 1	. .	. .		80,170	30,170	13,000	123,340
Region 2	169,000	7,000		2,960	62,150	12,000	77,110
Region 3	61,000	. .		89,000	60,910	12,000	161,910
Region 4	198,000	53,000		-71,000	-2,110	11,000	-62,300
Region 5	. .	. .		7,480	2,890	2,000	12,370
Totals	428,000	60,000		108,420	154,010	50,000	311,430

Source: Computations were made on the basis of primary data obtained from the Planning and Development Department, Government of West Pakistan, Lahore.



shortage of nitrogenous and phosphate fertilizers in these regions, with the highest deficit being in Region 1, and the lowest in Region 5. The only region which has a surplus in the production of nitrogenous and phosphate fertilizers is Region 4. On the whole, there would be an overall shortage of potash in almost all the regions by the year 1974-75. Since the cumulative amount of nitrogenous, phosphatic, and potash deficits is much greater, decisions must be made concerning the development of indigenous fertilizer production capacity and fertilizer imports. A larger regional imbalance implies a larger volume of inter-regional trade in fertilizers. The cornerstone of the new strategy of fertilizer distribution is the shift of reliance from the up-country movement of fertilizers from the remotely placed single major seaport of West Pakistan to the intensive development of inter- and intra-regional low capacity routes. In other words, a chain of fertilizer producing plants will have to be organized in keeping with the official policy of import substitution. Considering the annual average rate of foreign exchange costs of \$88 million for the period 1970-1975, the cumulative costs would amount to \$440 million. Taking into account the annual fertilizer consumption and an allowance for a minimum level of annual stock requirements, the fertilizer import needs of West Pakistan would amount to 479 thousand nutrient tons which would give an impressive leeway for



the substitution of indigenous fertilizer production capacity for fertilizer imports.

An increasing volume of fertilizer imports and the rising foreign exchange cost of imports in Table 5.3 indicates the possibilities of import substitution. In order to save high opportunity cost foreign exchange the potential demand for fertilizer suggests that it would be desirable, if a fertilizer plant were located in Region 1 with the production capacity of 300 thousand tons of ammonium sulfate or 160,000 tons of urea, also two phosphate plants with an annual rated capacity of 125 thousand tons for the production of triple superphosphate could be set up in Regions 2 and 3.

The new mechanism of physical distribution involves the coordination of the movement of fertilizer and transportation at various focal points in the distribution structure. In response to the expanding demand for fertilizer at the farm level and rising rate of fertilizer use per acre, it is recommended that distribution centers be located at each district headquarters. The functions of these distribution centers would be the replenishment of supplies of distribution sub-centers located at tehsil level. Their functions would include the assessment of fertilizer demand by each type of nutrient at the district level, the availability of fertilizers at the required time and place, and to maintain a constant liaison with the sub-distributors. They must provide soil testing

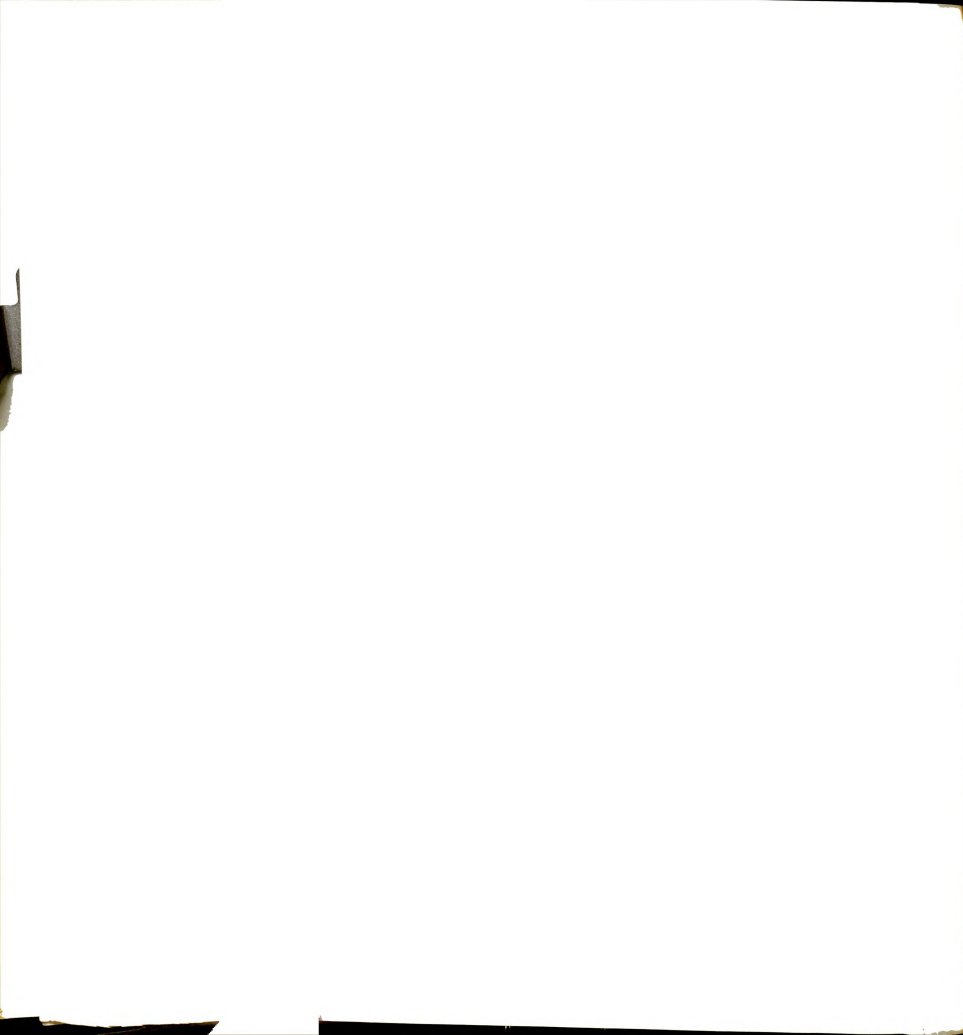


TABLE 5.3. Foreign Exchange Costs of Fertilizer Imports.

Year	Fertilizer Consumption and Stock Requirements (nutrient tons)	Indigenous Fertilizer Supply (nutrient tons)	Import Requirements (nutrient tons)	Foreign Exchange (US dollars)
1970-71	527,000	150,000	377,000	79,170,000
1971-72	609,600	152,000	457,600	96,096,000
1972-73	715,200	266,000	449,200	94,332,000
1973-74	727,200	397,000	330,200	69,342,000
1974-75	960,000	481,000	479,000	100,590,000

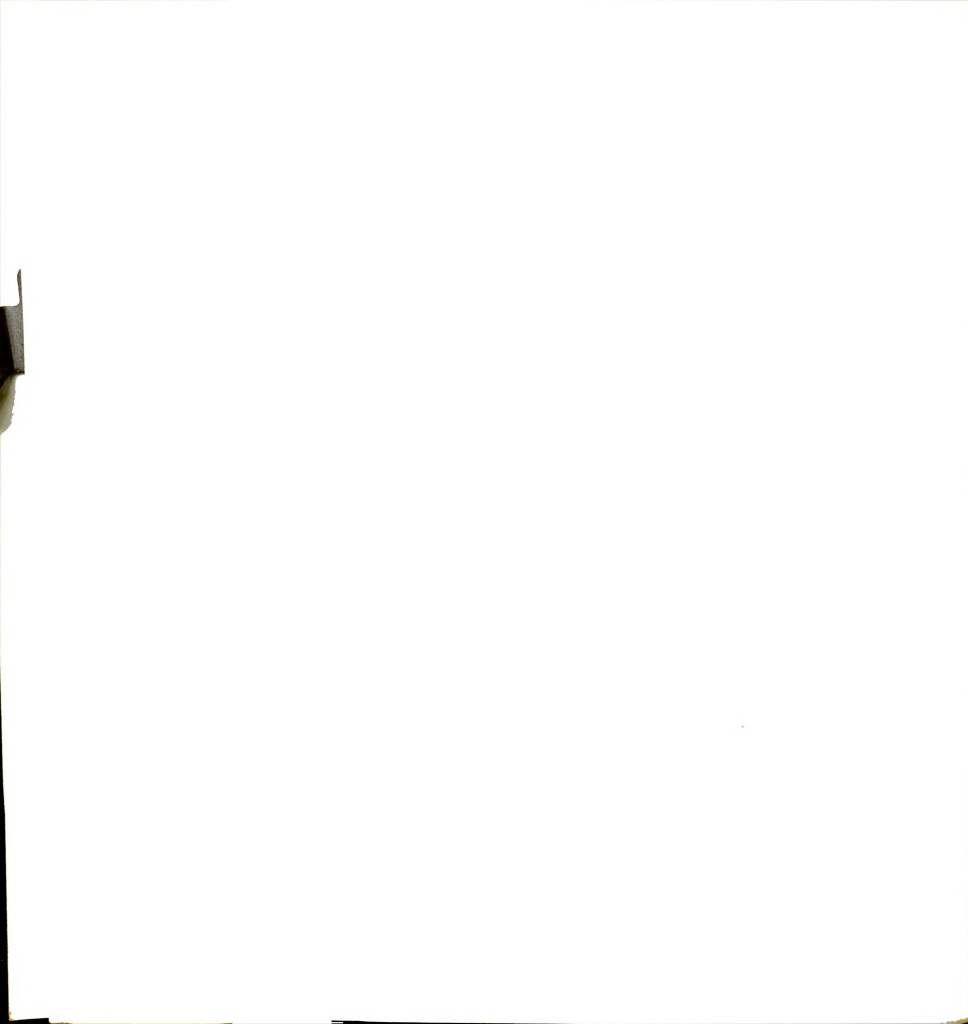
Note: (1) International prices of fertilizer are assumed to be \$210 per ton. (2) Stock requirements are based upon 1/5 of the consumption needs.

Source: Computations were made on the basis of data obtained from the Planning and Development Department, Government of West Pakistan, Lahore.



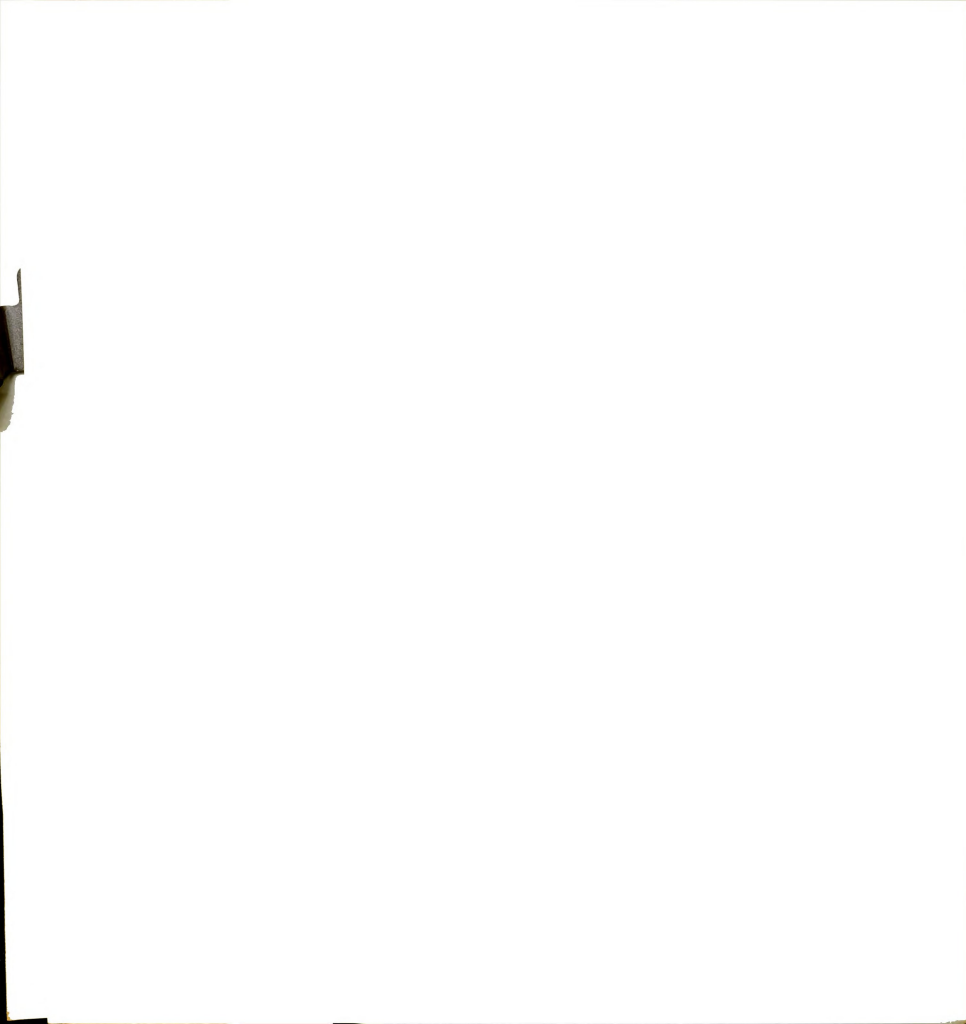
facilities to the farmers by receiving soil samples through their distribution sub-centers and mailing them directly to the farmers who, in turn, get the necessary interpretation of their mailed soil samples from their respective extension workers. A system of supervised credit for farmers and inventory financing may be organized at the district level as a necessary adjunct of the distribution system. Since fertilizer distribution is closely enmeshed with the transportation system of the country, it would be necessary that workings of each distribution center be coordinated with railway and other transport concerns at the district level. Lack of coordination between transportation and distribution can, however, result in unnecessary delays in the shipment of fertilizers. Since the existing system of agricultural extension is inadequate, it would be desirable if the fertilizer sales personnel are stationed at the district level who work in close cooperation with the fertilizer distributors in order to spearhead the process of demand expansion.

On the other hand, the functions of sub-distributors at tehsil level would be to channel the available fertilizer supplies to the retail outlets falling within the range of a particular sub-division. The major problem of distribution sub-centers would be to maintain a close working relationship with retailers who stand in need of fertilizer credit and transportation facilities. Their responsibility would include the provision of fertilizers



to retailers in appropriate mixtures, collection of soil samples, and assessment of the nature and seasonality of demand in their respective regions. They must take into account the level and intensity of fertilizer use, the types of crops sown, availability of complementary inputs, and pattern of farm practices. They must consider the problems that confront the farmers arising from fertilizer use. A major flaw of the existing rail and road transportation system is that it simply connects major towns with cities while leaving the rural areas where the actual consumption of fertilizers takes place, completely isolated from the mainstream of modern transportation. At present, there exists no well organized trucking service at tehsil level which could be used for the short haulage of fertilizers. Thus it would be necessary to coordinate the system of fertilizer distribution with transportation at both the wholesale and retail levels.

From a theoretical point of view, the logic underlying such a system of distribution center location is to provide maximum consolidation economies by purchasing supplies from distant procurement points and to effect the transfer of cost and service benefits to retail stores with a relatively shorter delivery. The contention of this theory is that a firm possessing differential advantage holds a temporal monopoly over a market segment. The normal reaction of other firms is to adjust their market offers to overcome this differential advantage by



shifting to a new industry equilibrium. Within the framework of competition for differential advantage, location strategy gains eminence in the theory of the firm. To the degree that the firm achieves control over a geographical market segment, its market position is entrenched by virtue of a spatial monopoly. Apart from political and geographical considerations, a spatial monopolist viewing superior location as a temporary spatial advantage and utilizing linear market assumptions and price structure based on f.o.b. mill prices would select that location which minimizes the freight cost and allows for profit maximization. The solution of market center location for a spatial monopolist is where MM' represents a linear market, L_1 represents the location in the following diagram.

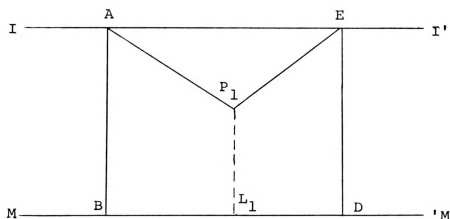


Figure 5.2. A Diagram of the Optimum Location of the Spatial Monopolist.



In this figure P_1 is the net mill price, and AB and/or ED represents the delivered price level at which fertilizer is offered to consumers located at various points in the market. The line labeled II' represents farmers' price indifference. The underlying assumption is that farm-consumers would uniformly reject monopolists' product, if the total delivered price exceeds the level indicated by II'. At the level of II', the consumer is generally indifferent to the purchase of product since he can obtain a higher degree of satisfaction by utilizing his resources in alternative ways.

Under conditions of imperfect competition the firms engaged in distributing fertilizers would, thus, try to obtain a partial control over the market by seeking the location that provides the highest total revenue at lowest possible cost which is assumed to occur at a uniform point in all directions resulting in a circular market area. It is, however, assumed that initially the spatial monopolist would sell fertilizers in all directions to the point of farmers' indifference to fertilizer price with the pre-condition that market prices are freely determined. Due to low price elasticity of demand sales intensity is, however, assumed to be the highest in areas surrounding the monopolists' location and would tend to decrease in magnitude as fertilizer was sold in farther hinterlands. The following diagram presents the demand cone where L_1 represents the spatial monopolists' location, the circle represents the



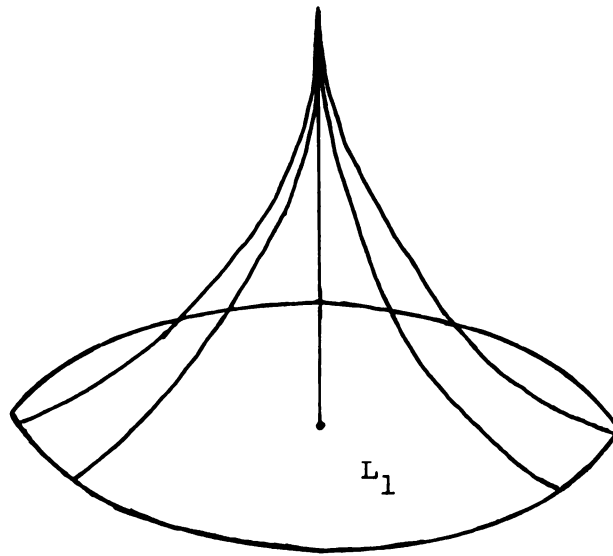
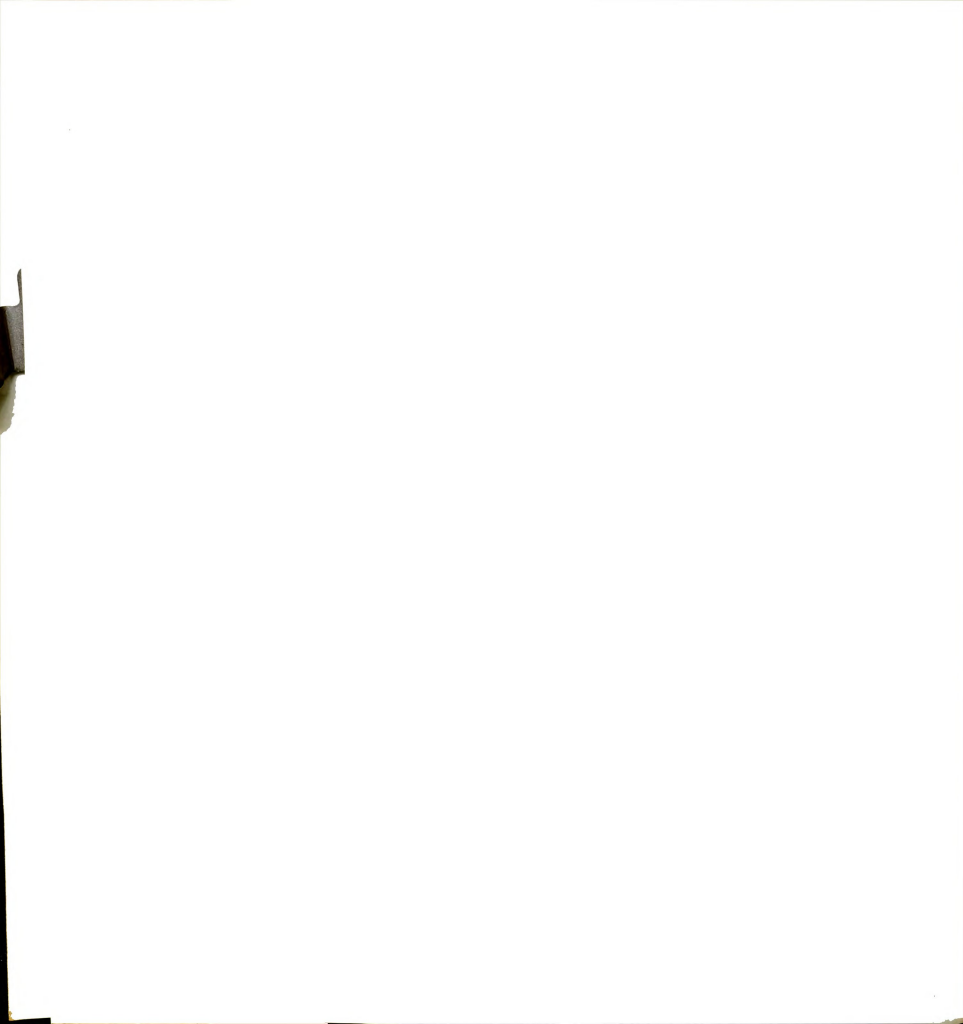


Figure 5.3. The Diagram of Spatial Monopoly.

total market area and height of the cone represents the intensity of the farmer's demand for fertilizer. The circumference of the fertilizer sales territory around the distribution sub-center, e.g., tehsil level is limited by fertilizer price and the farmers' indifference level for this farm input. The fertilizer market for a single spatial monopolist would, however, be limited by its price elasticity of demand. Thus from the entire fertilizer industry's point of view each firm engaged in distributing fertilizers would serve areas offering highest demand potential and all such firms would select least-cost locations from which profits could be maximized. The net result is a series of space islands between the market areas serviced by each of the spatial monopolists. Space



islands occur as pockets in which monopolists are unable to sell at acceptable profits which is illustrated in the following diagram.

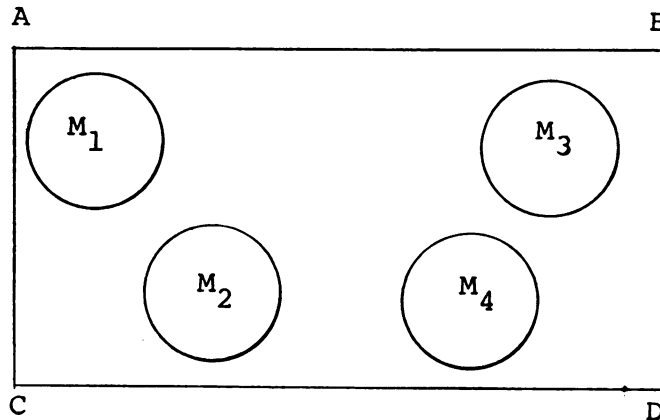
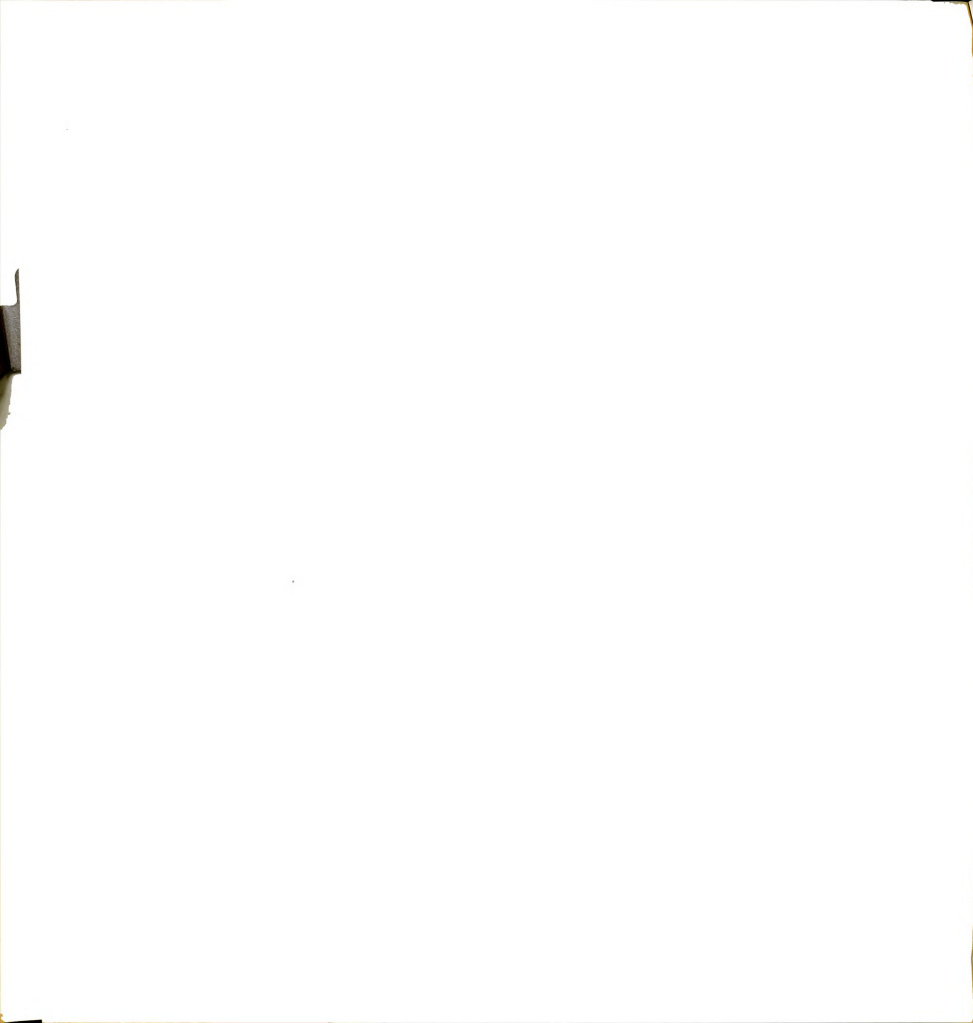
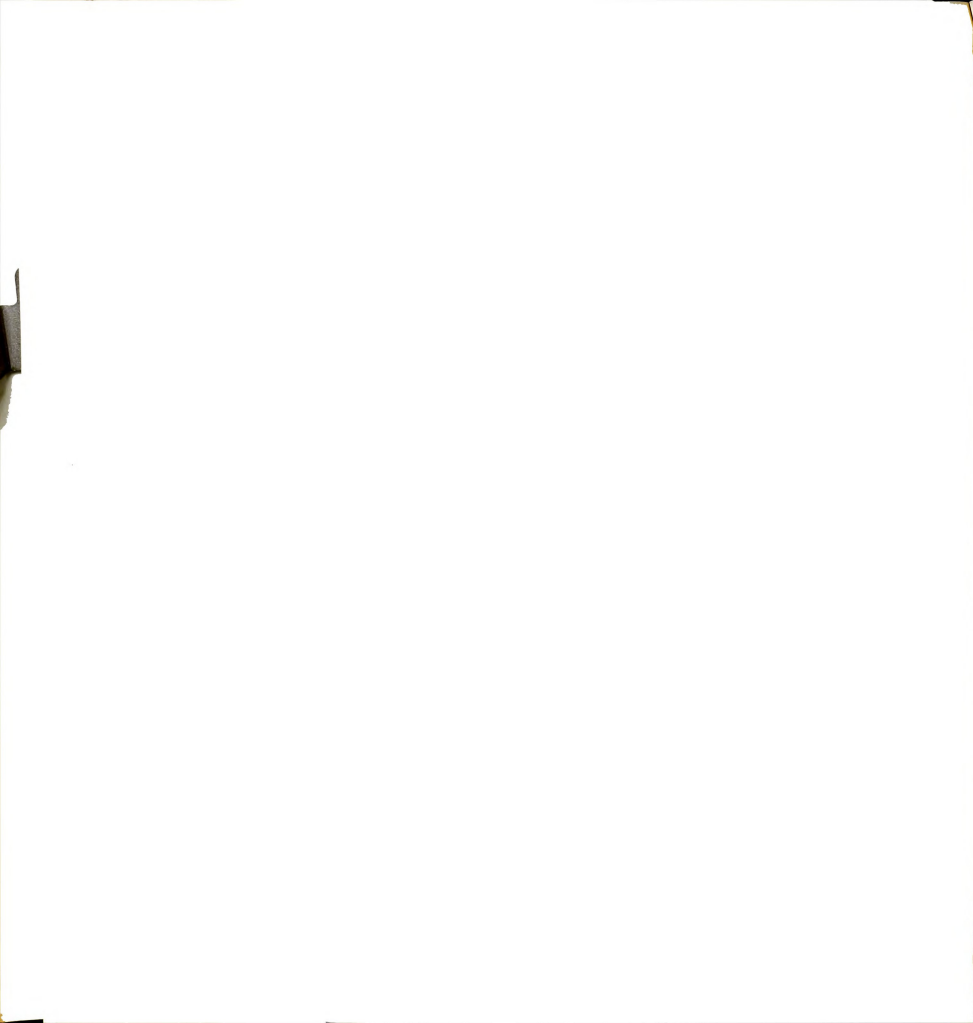


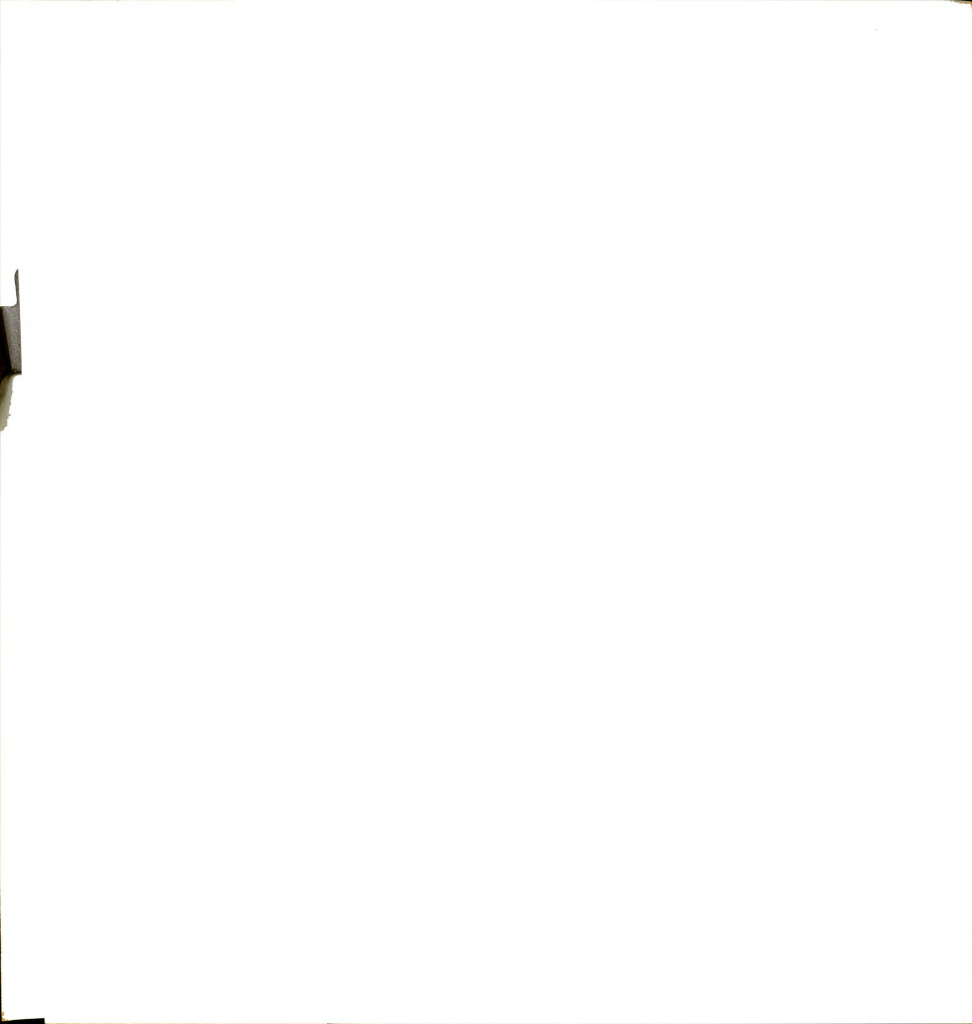
Figure 5.4. Space Islands Under Conditions of Spatial Monopoly.

The area ABCD is assumed to represent the market areas of individual monopolists whereas the rest of the areas constitute space islands where the spatial monopolists do not find it profitable to sell. In the long run, however, all such space island will be filled by small-scale firms operating from high cost location. In other words, it is assumed that in the short run, size of the market is limited which is expected to expand in the long run due to such factors as greater consciousness of farmers, increased availability of complementary inputs, and rise in farm income. Under the prevailing conditions in West Pakistan, the area ABCD is supposed to represent a specific fertilizer region as already classified which, in turn, may



be repeated in all of the five regions. It is assumed, however, that circular market areas represent low-cost fertilizer distributors either because of the economies of size and scale or due to superior techniques of fertilizer distribution which may be better represented as spatial monopolists. The strategy of a spatial monopolist would be to extend his market coverage by locating distribution centers in the circular market areas, i.e., M_1 , M_2 , etc., and attaining higher barriers to entry for less competitive distributors. Assuming that each of the spatial monopolists operating in the fertilizer market of West Pakistan is a vertically integrated distribution agency, he would initially sell fertilizers at f.o.b. mill prices over his entire market area by direct delivery. The spatial monopolist by reducing the transportation expense through the consolidation of fertilizer shipments to a distribution center can result in the movement of large quantities of fertilizer into market areas heretofore beyond his reach at a total price considerably below the farmers' price acceptance level. Fertilizers may be distributed f.o.b. distribution center in all directions to a point where total fertilizer price reaches the farmers' price indifference level resulting in a considerable expansion of markets. Under conditions of direct shipment, the monopolist is able to sell only as far into the market as point D in Figure 5.5.

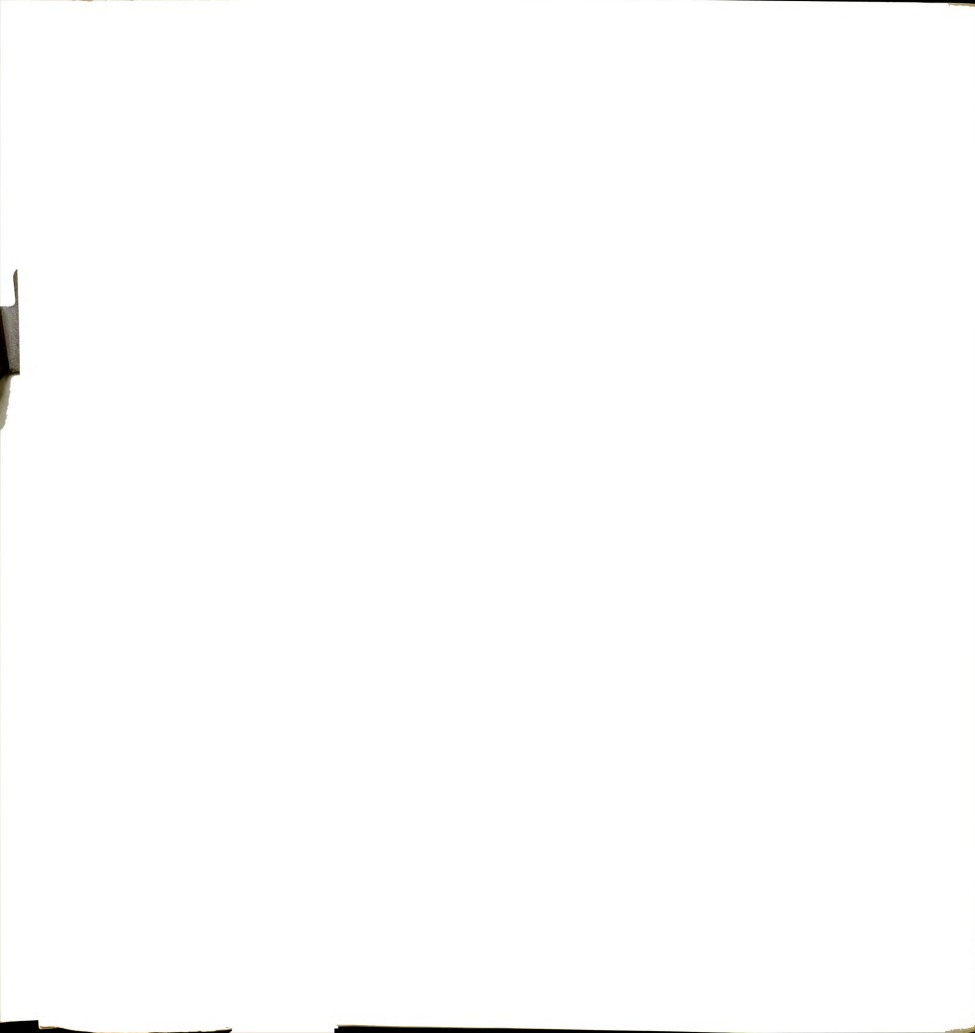




distribution center at some point in the market beyond D, the distributor would be able to make consolidated shipments to the distribution center at a landed cost below the farmers' indifference price as indicated by the line P_1CL . Shipments would then have to be returned toward the production point P_1 and farther out into the market area until total retail price of fertilizer once more becomes prohibitive to the consumer. The total market expansion achieved by utilizing a distribution center is, however, expressed in the linear diagram by the area DC.

Transportation Needs

Transportation constitutes a vital link in the physical movement of fertilizer from the points of production to the points of ultimate consumption. The extent to which rail and road fertilizer handling capacity must be expanded depends to a large extent on the magnitude of fertilizer deficit in various regions and fertilizer import needs of West Pakistan. Since the new scheme of fertilizer distribution indicates a shift of reliance from fertilizer imports to the domestic production of fertilizers, the development of a well-knit framework of high capacity rail and road routes that connect the collection distribution centers with the distribution sub-centers and low capacity routes that connect the distribution sub-centers with the villages would be necessary. An increase in inter-regional trade would require a well developed



high capacity rail system as a measure towards achieving greater market efficiency. The ratio in which a given budget should be spent for the development of rail and road transportation capacity would depend on the choice a shipper would make for a given structure of freight rates and the least cost combination of intermodal shipment that he would select for a specified quantity of fertilizers. Since railways tend to enjoy greater economies of scale than road transport, the former as a low priced mode of shipment gets preference over the latter for fertilizer haulage over longer distances. On the other hand, the capital costs of installing rail transportation systems are much higher than road construction. Thus the expansion of railway fertilizer handling capacity would be necessary where longer haulage is concerned, i.e., 100 miles and above whereas expansion in road transportation capacity must be undertaken over short hauls involving less than 100 miles. Table 5.4 presents the pattern of freight rates for various tonnages of fertilizer shipment.

The comparative rate structure of fertilizer shipment by rail and road as given in Table 5.4 shows an apparent superiority of fertilizer transport by freight trains over road haulage. The high ratio of the cost of fertilizer shipment per ton-mile to the f.o.b. mill price per ton of fertilizer indicates the extent to which the benefits of lower fertilizer prices can be redistributed to farmers through reduced cost of transportation.

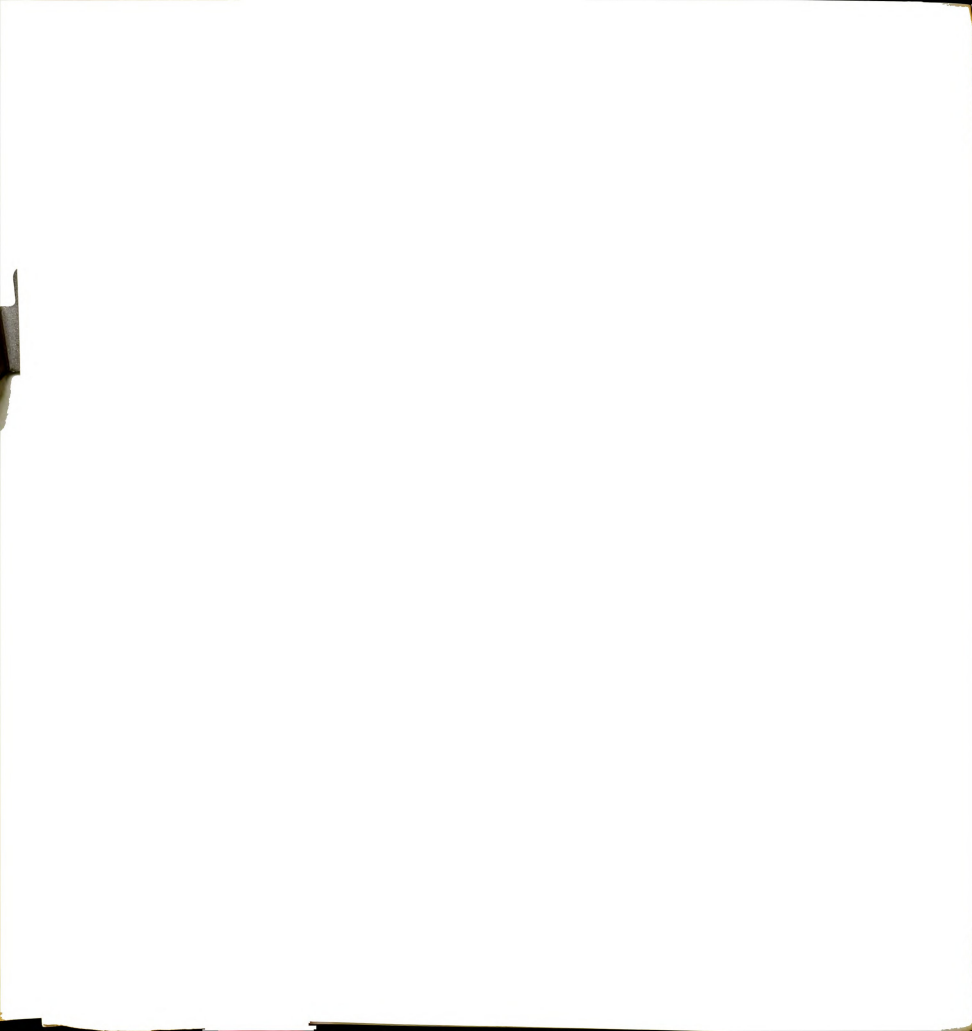
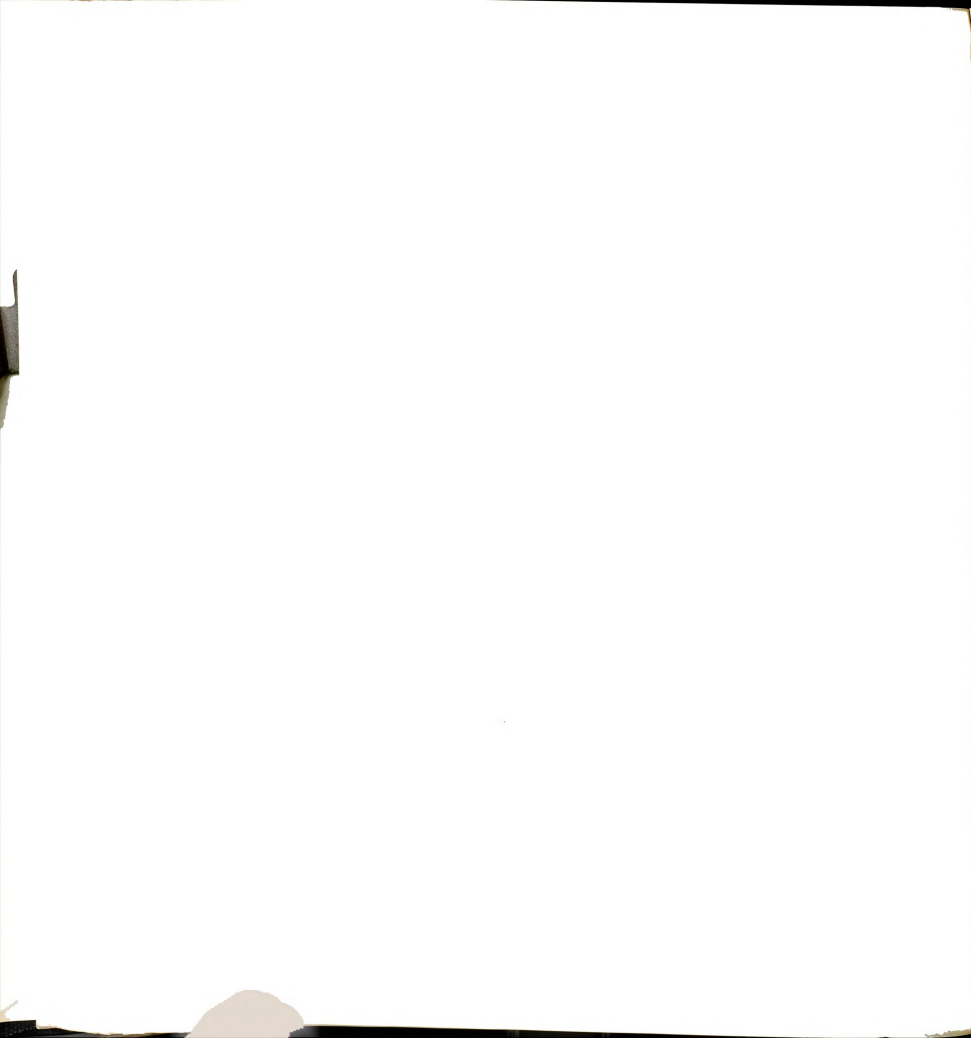


TABLE 5.4. The Structure of Rail and Road Fertilizer Freight Rates (in maunds and Rs).^a

Origin/ Destination	500 Maunds		400 Maunds		250 Maunds		150 Maunds		45 Maunds	
	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road
<u>Short-Haul</u> Lahore-Lyallpur	145.00	200* 160†	124.00	200 160	87.50	100 80	66.00	100 80	19.80	45 33.75
<u>Medium-Haul</u> Lahore-Sahiwal	150.00	200 180	128.00	200 180	90.00	100 90	67.50	100 90	20.25	45 45
Lahore-Rawalpindi	185.00	320 300	156.00	320 300	112.50	160 150	84.00	160 150	25.20	67.50 45
Lahore-Multan	200.00	360 300	168.00	360 300	120.00	180 150	90.00	180 150	27.00	67.50 56.25
Lahore-Peshawar	235.00	400 400	200.00	400 400	142.50	200 200	106.50	200 200	31.95	78.25 67.50
<u>Long-Haul</u> Lahore-Hyderabad	365.00	1400 1200	308.00	1400 1200	220.00	700 600	165.00	700 600	49.50	157.50 112.50
Lahore-Karachi	400.00	1600 1450	336.00	1600 1450	240.00	800 725	180.00	800 725	54.00	180 135

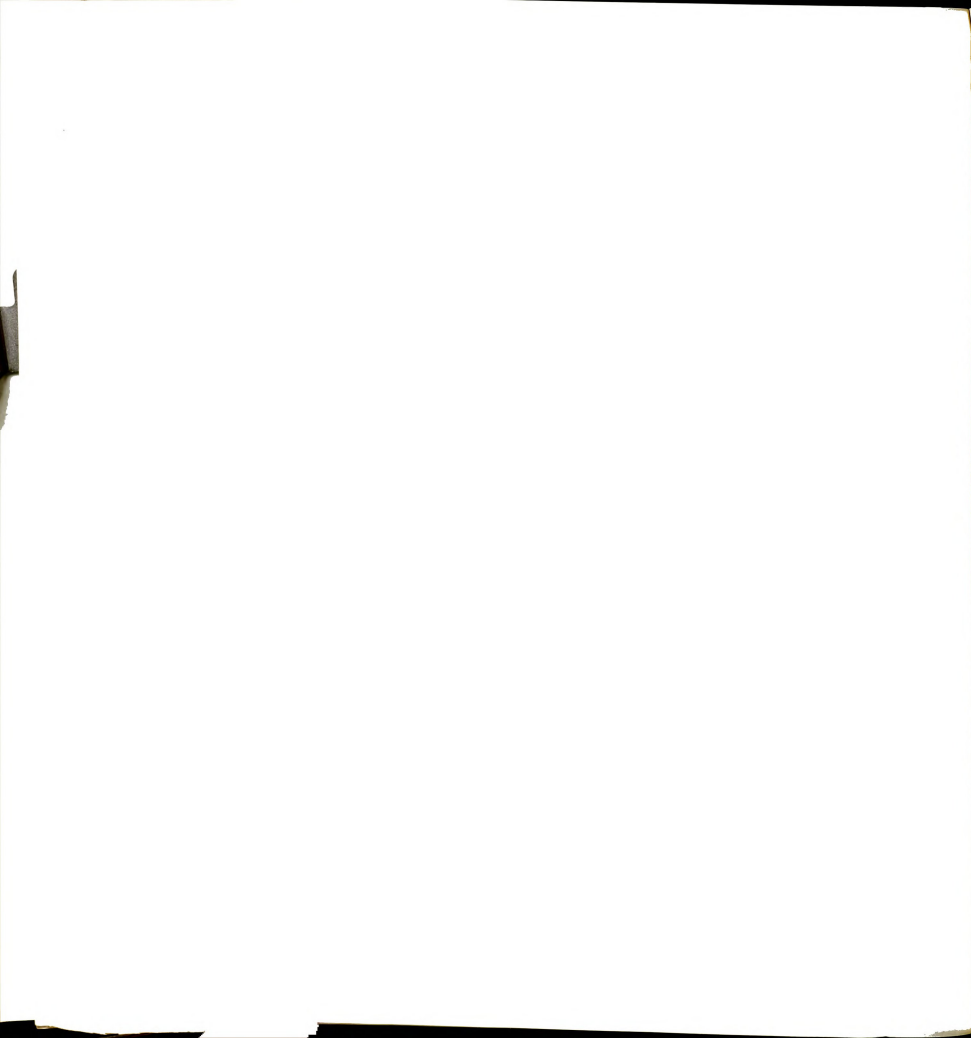
*High Rate †Low Rate ^aMaunds = 82.266 pounds; one rupee = \$.21.

Source: An unpublished memo issued by the transportation cell of the Planning and Development Department, Government of West Pakistan, Lahore.



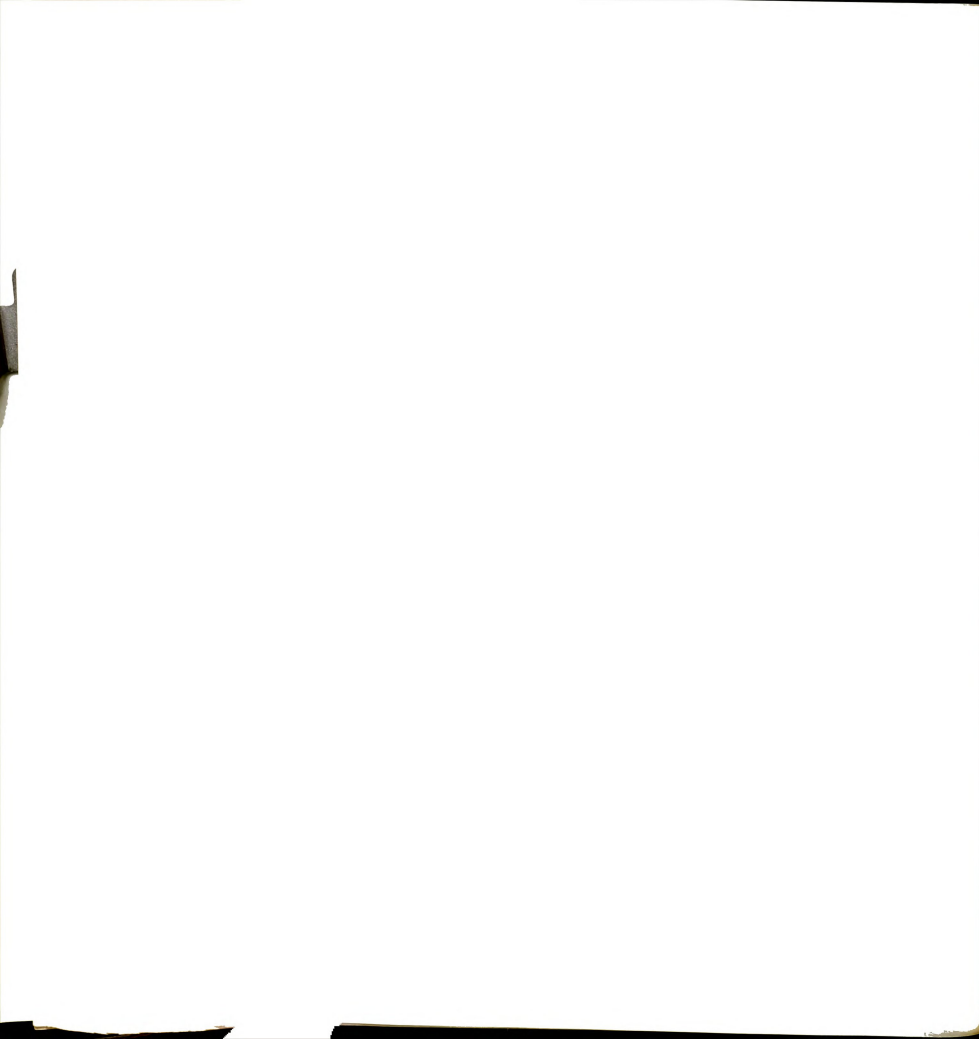
Greater efficiency and lower freight rates in fertilizer handling may, however, be attained if the existing public policy of giving preference to passenger trains over freight trains can be done away with. A reduction in the freight rates would, however, lead to increased use of fertilizer handling capacity which is limited because of the existence of a single spherical track that connects Karachi with the remote areas of Peshawar division. The limited freight handling capacity of the trains is subject to further competing demands from a multitude of transportable items ranging from livestock, farm products, minerals, semi-finished, and manufactured goods. The rail freight rates can be kept down only if the expansion in freight handling capacity takes place which would lead to an increase in total revenue because of the existence of inelastic demand for freight train services.

The second area of concern is the scattering of focal points within each of the grids that serve as collection and distribution centers. It relates to the pattern of intra-regional fertilizer shipment that would be adopted in order to intensify the fertilizer distribution activity in rural areas. In other words, apart from expansion in fertilizer handling capacity at the macro-level, establishment of inter-connected low capacity routes at the micro level would be necessary. Since the various distribution centers and distribution sub-centers are supposedly located at the district and tehsil levels



respectively, they must be inter-connected through a well laid out railway track which is especially lacking in the remote areas of West Pakistan. A rescheduling of trains and an alteration in the system of priorities would have to be undertaken in order to ensure the arrival of freight trains on time. Fertilizer unloading facilities must be increased at each point of destination and regular trucking service must be floated between distribution sub-centers and the railway station which may be further used to make fertilizer delivery to retailers.

A major flaw in the existing system of transportation is the almost nonexistence of a thin grid of low capacity routes that could blanket and connect the rural areas of West Pakistan with mandi towns and cities. Except for a few village access roads that tend to proliferate in the important rural areas, the rest of rural West Pakistan remains almost completely detached from the major economic centers. That the efficiency of transportation system is directly correlated with the availability of a certain minimum density of farm-to-market roads is verified by the comparative analysis of the number of miles of farm-to-market roads per square mile of cultivated land which in Britain, France, Japan, and the United States is calculated to be around four to one in contrast to a ratio of three to one in Taiwan and Denmark, three-fourths to one in Malaya, around one to one in the Philippines, and two-thirds to one mile of road to a square mile of cultivated



land in West Pakistan.⁴⁹ The fact that rural road building can accelerate the rate of agricultural development and improve the efficiency of resource use by increased local availability of farm inputs is borne out by the experience of the Philippines where the construction of improved feeder roads connecting the farming communities to paved highways to which they had previously no road access led to a doubling of the sale of corn and tobacco with the time-lag of only a single year.⁵⁰ The most common means of conveyance in rural West Pakistan is bullock carts which are frequently used for carrying fertilizers, seeds, seedlings, and other farm inputs to the fields and marketing of harvested crops back to the towns. It has been calculated that the average ton-mile costs of a bullock cart are as high as 20 to 40 cents while the service is no better than three miles per hour.⁵¹ It would, therefore, be more economical to substitute trucks for bullock carts and other beasts of burden which are not only expensive but also inefficient. Since most of the villages in West Pakistan remain isolated from

⁴⁹President's Science Advisory Committee, The World Food Problem (Washington, D.C.: The White House, May, 1967).

⁵⁰Arthur T. Mosher, Getting Agriculture Moving: Essentials for Development and Modernization (New York: Frederick A. Praeger, Publishers, 1965).

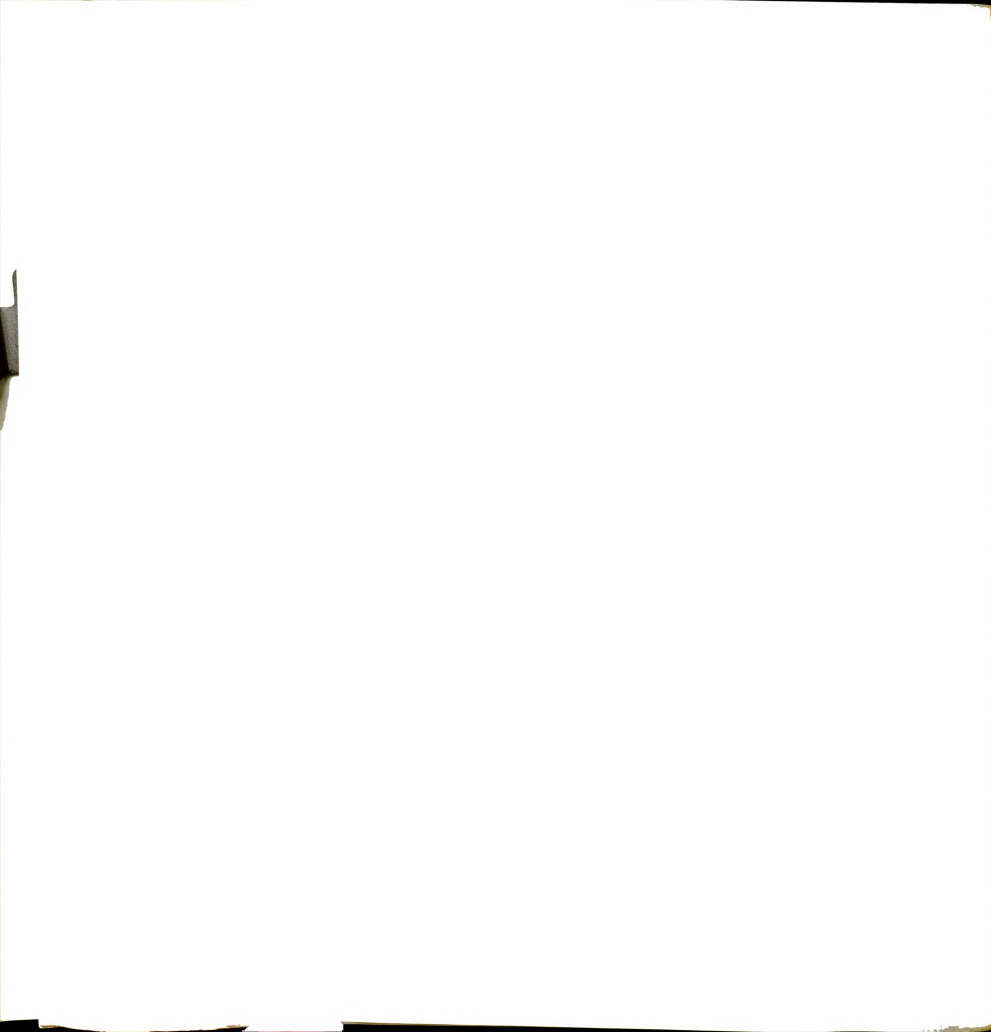
⁵¹Ibid.



a good all-weather road at an average distance of one to twenty miles, it is speculated that the construction of adequate motorable roads would be necessary in order to obtain the operating costs of a truck to one-tenth of a camel. In addition, an improvement in the fertilizer marketing system would require an increased ratio of farm-to-market roads per square mile of cultivated land. From a qualitative point of view, construction of good motorable intercity and farm-to-market roads can lead to faster delivery and lower operating and maintenance costs in truck haulage. A comparative study of the level of transportation efficiency that can be obtained in terms of time by truck on good versus bad roads is attested to by the fact that in Puerto Rico both small and big trucks traveled a round trip in about two and one-half hours on good roads as compared to three and one-half hours by small, five hours by medium, and six hours by big trucks and trailers on bad roads.⁵²

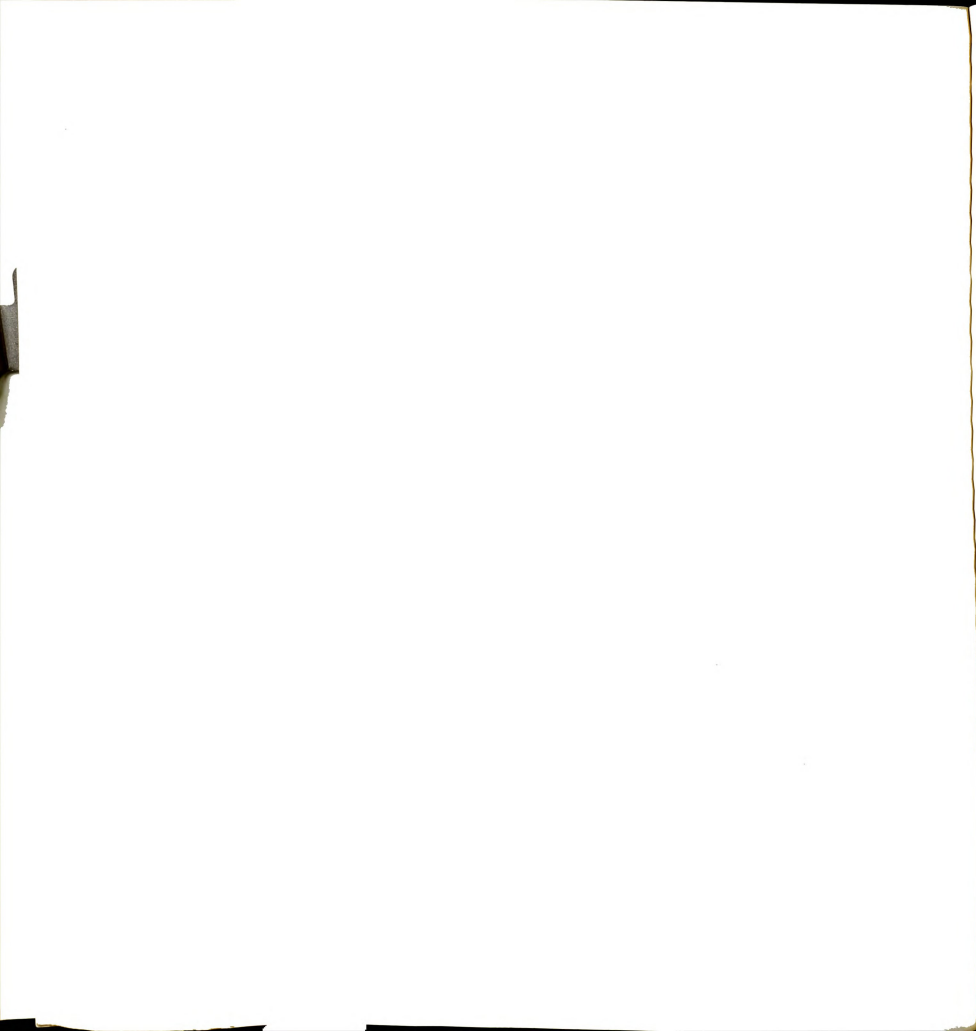
A fine-mesh network of low capacity routes must be organized in order to streamline the process of fertilizer distribution in rural areas. Since the farming areas are crosscrossed by a multitude of canals and distributory outlets, a series of bridges and culverts would have to be constructed to facilitate the process of inter-area transshipment. Thus an efficient system of transportation

⁵²Holton and Galbraith, Marketing Efficiency in Puerto Rico.



constitutes a vital link in the fertilizer marketing system of West Pakistan where farms have been increasingly assumed to take the role of "assembly lines." Improved efficiency in the system of transportation will have two-pronged effect in terms of speedy movement of the increased marketable surplus and improved market prices as well as faster delivery and increased local availability of fertilizer at competitive rates at the farm level. On the contrary, a poor and expensive system of transportation leads to lower levels of fertilizer use in distant areas and would tend to limit fertilizer market expansion. It would lead to greater inter-market price spreads, increased market imperfection involving greater chances for inter-market price collusion among the traders provided we assume a free market price system.

The existing system of rail and road transportation, undoubtedly, remains a constraint on the physical distribution of fertilizer in West Pakistan. Since the government does not have adequate resources to implement a series of recommendations, as a short-run measure, the government may develop a list of priorities in order to improve the efficiency of transportation by greater capacity utilization and taking into hand that critical sequence in the system of fertilizer transportation which has the greatest effectiveness in the improvement of overall efficiency. In the long run, however, measures



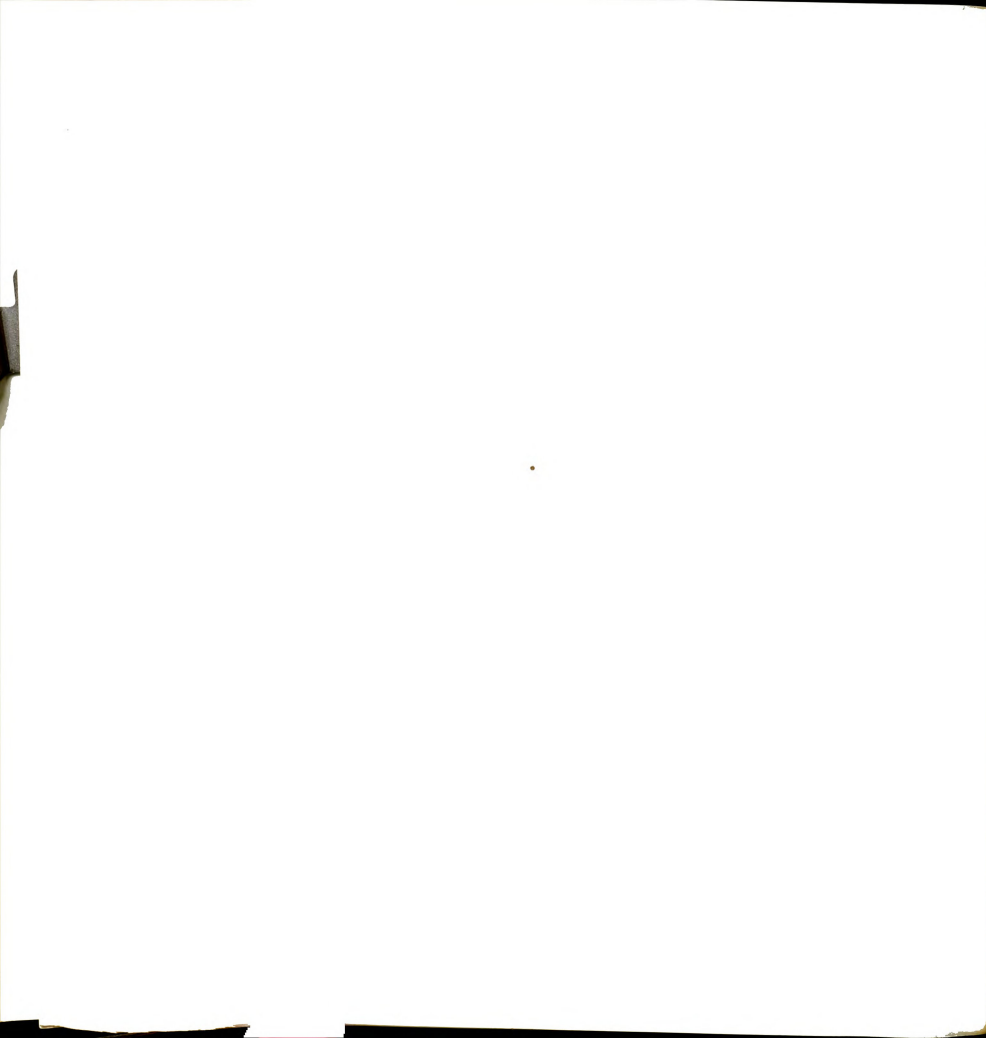
can be taken to reduce the real cost of local fertilizer delivery through the proliferation of low capacity routes. Apart from increasing the level of efficiency in fertilizer transportation, a larger railroad system would generate broader benefits of handling a growing volume of import and export trade as well as inter- and intra-regional trade. It would lead to reduced social costs that tend to operate due to a constrained system of transportation and realization of private costs over the long run due to a large number of secondary benefits that it generates.

Estimation of Warehouse Requirements for
Fertilizer in West Pakistan

The extent to which warehousing capacity must be provided in various regions by the year 1974-75 will be determined by a number of factors relating to the pattern of fertilizer distribution, the nature and magnitude of regional demand for fertilizer, and the rate of stock turn over. A major consideration in the location of a warehouse would be the minimization of in-bound and out-bound shipment costs. The strategy of warehouse location must be based upon the design of distribution center location as already mentioned. Fertilizer storage facilities must, however, be provided at the Karachi seaport in order to generate a smooth up-country flow of fertilizer through a limited rail transport capacity and to handle the irregular arrival of shipments of imported fertilizers.



As a measure of broader fertilizer policy, buffer stocks must be maintained in the various regions in order to even out the seasonal peaks. Due to the fact that the structure of fertilizer demand is spatially dispersed, a chain of warehouses would have to be organized at various strategic places in all the regions. It will, however, be in the producers' own interest to maximize their revenues by locating a series of warehouses at their indigenous fertilizer producing plants to handle the continuously generated supply of fertilizers which tend to be widely different from the seasonal pattern of demand. As a necessary adjunct to the scheme of fertilizer distribution, warehouses may be located at the district and tehsil levels where a certain minimum level of inventory could be maintained to regulate the flow of fertilizers in keeping with the pattern of demand. The lowest but most important tier in the scheme of warehouse location is the organization of small and cheap warehouses at retail levels where the level of inventory during the particular harvesting period is not expected to exceed sixty tons of fertilizer. At this level, quick replenishment of inventory would be necessary in order to ensure prompt lift off by the farm buyers. On the other hand, in the remote farm areas of West Pakistan where the level and intensity of fertilizer use is very low and the absolute demand so meager that the construction of warehouses would be uneconomical, it would



be desirable that the marketing radius served by a single warehouse be expanded in such cases. An adequate system of transportation would be needed to ensure effective local fertilizer delivery. In some instances, private warehouses or open-space storages are also used where the available supply of fertilizers can be sold off during a short period of time. Assuming that warehousing capacity must be allowed for at least one-half of the total requirement in a region whereas the other half is assumed to be purchased as soon as it arrives, Table 5.5 shows that the extent to which warehousing capacity must be arranged for by the year 1974-75.

The data in this table indicates that the need for warehousing capacity is directly correlated with the demand for fertilizer in a particular region. Thus in order to tie up the scheme of warehouse location with the strategy of fertilizer distribution, it would be necessary that the capacity of warehouses be allowed to vary in direct proportion to the magnitude of area served and its demand for fertilizer in the larger interests of efficient capacity utilization. Apparently larger capacity warehouses can be located at the district and divisional levels whereas the smaller warehouses may be located at tehsil and mandi (local market) levels. Since the demand for fertilizer is seasonal, it would be more economical and convenient to design such warehouses that can be used to accommodate fertilizer, other agricultural

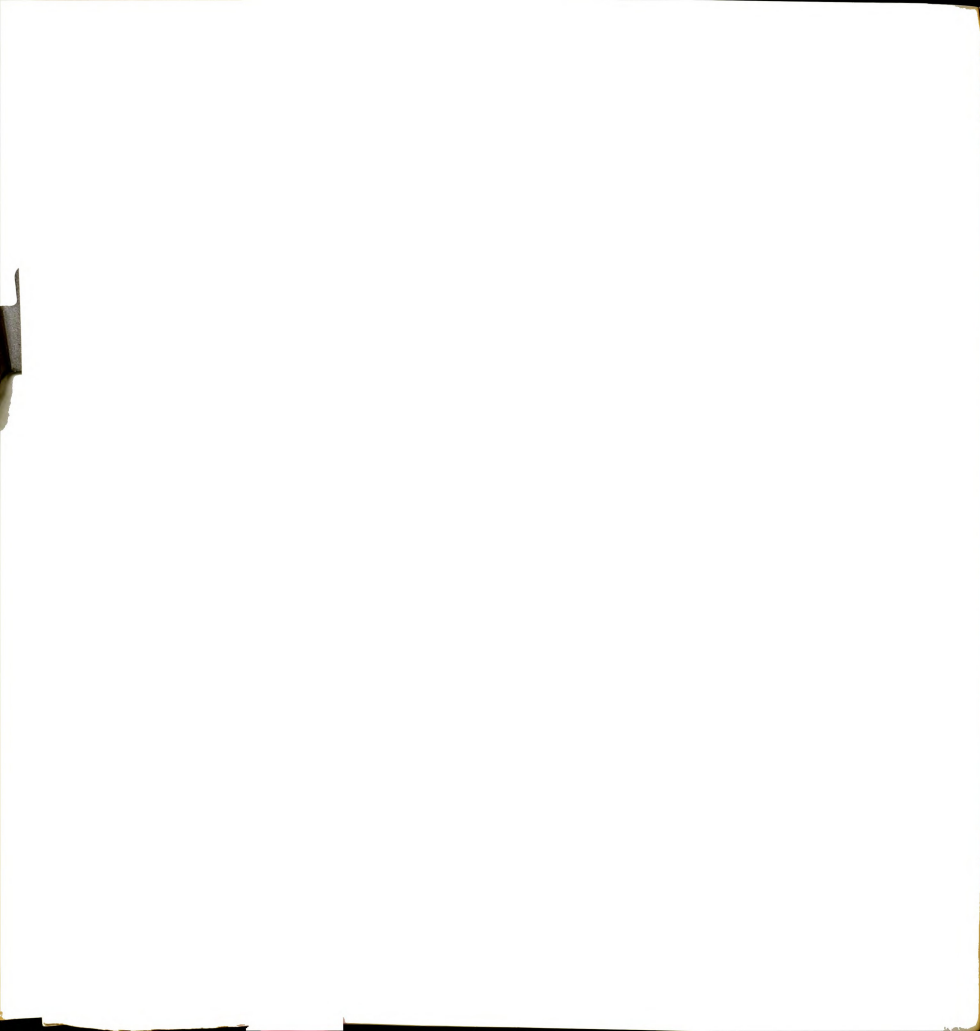
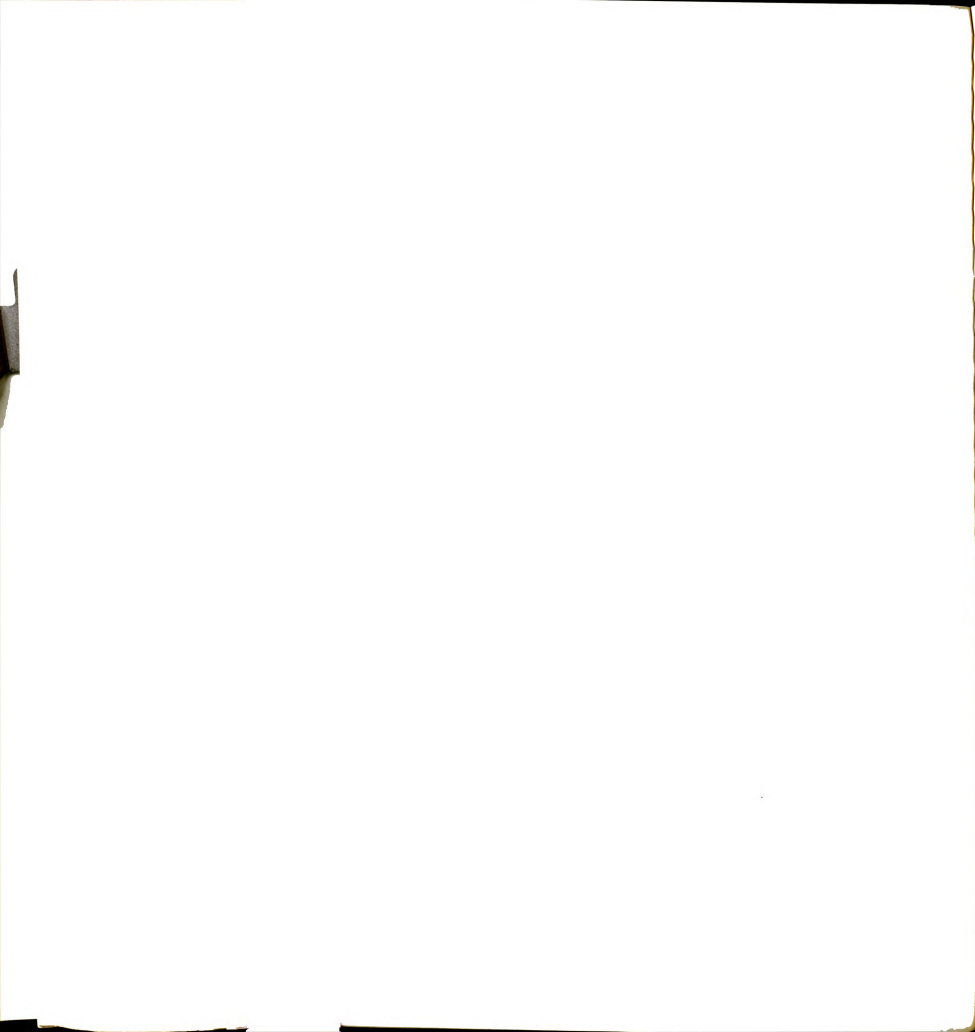


TABLE 5.5. Region-Wise Distribution of Warehousing Capacity up to 1974-75.

Regions	Nitrogen (product tons)	Phosphate (product tons)	Potash (product tons)	N-P-K (Total) (product tons)	Quantity of Storable Fertilizer (product tons)	Warehousing Needs in Square Feet
Region 1	381,762	188,563	65,000	635,325	102,554	512,770
Region 2	818,857	432,188	60,000	1,131,045	218,508	1,092,540
Region 3	714,286	380,688	60,000	1,154,974	192,496	962,480
Region 4	603,857	318,063	55,000	976,920	162,820	814,100
Region 5	35,619	18,063	10,000	63,682	10,614	53,070

Note: (1) Warehousing capacity has been provided for one-half of the total fertilizer requirement; (2) the rate of stock turn-over is assumed to be three per year; (3) the warehousing capacity provided for is five square feet per ton.

Source: The data for computations was obtained from the unpublished memo issued by the Planning and Development Department, Government of West Pakistan, Lahore.



inputs, and farm commodities in order to make a year-round use of warehousing capacity. Whereas it takes a time-lag to replenish the inventories at both wholesale and retail levels and a proportion of the overall fertilizer supply is met through imports, impact of seasonality of demand would tend to be greater at the retail level rather than at the district or provincial level. Thus the functions of warehouses can be assumed to be specialized at the provincial and district levels and diverse at the retail level where the warehousing capacity can be utilized during the crop seasons only and can be put to alternative uses during the rest of the season. On the other hand, buffer stocks can be maintained at the wholesale level in order to discount the uncertainty arising from fertilizer imports.

The costs of supplying required warehousing capacity are gradually increasing because of the rising volume of fertilizers that must be stored in response to an ever-increasing fertilizer demand. An assessment of the magnitude of storage supply costs can be made from Table 5.6.

As a measure of price policy, additional quantity of fertilizers will be stored so long as intra-seasonal price spread exceeds the long-run marginal cost of providing storage which is an apparent justification for a return to free market pricing system from a publically

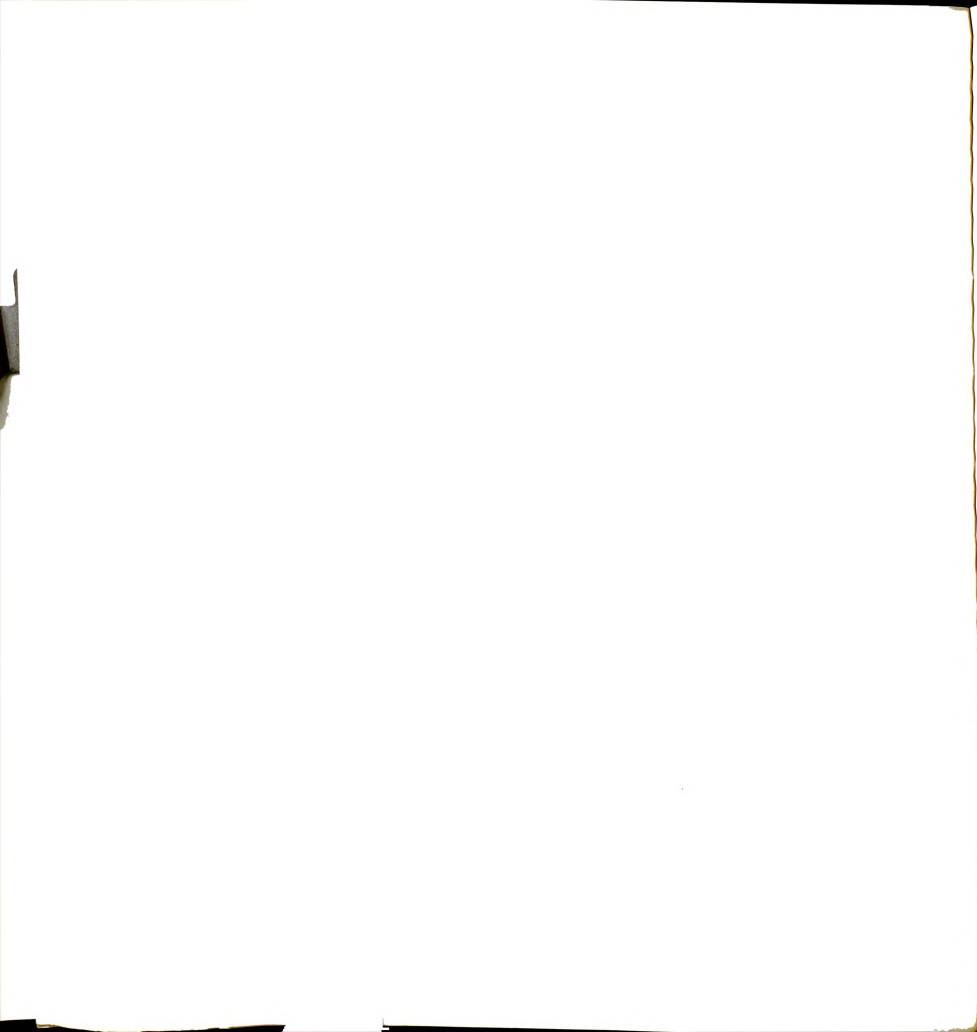
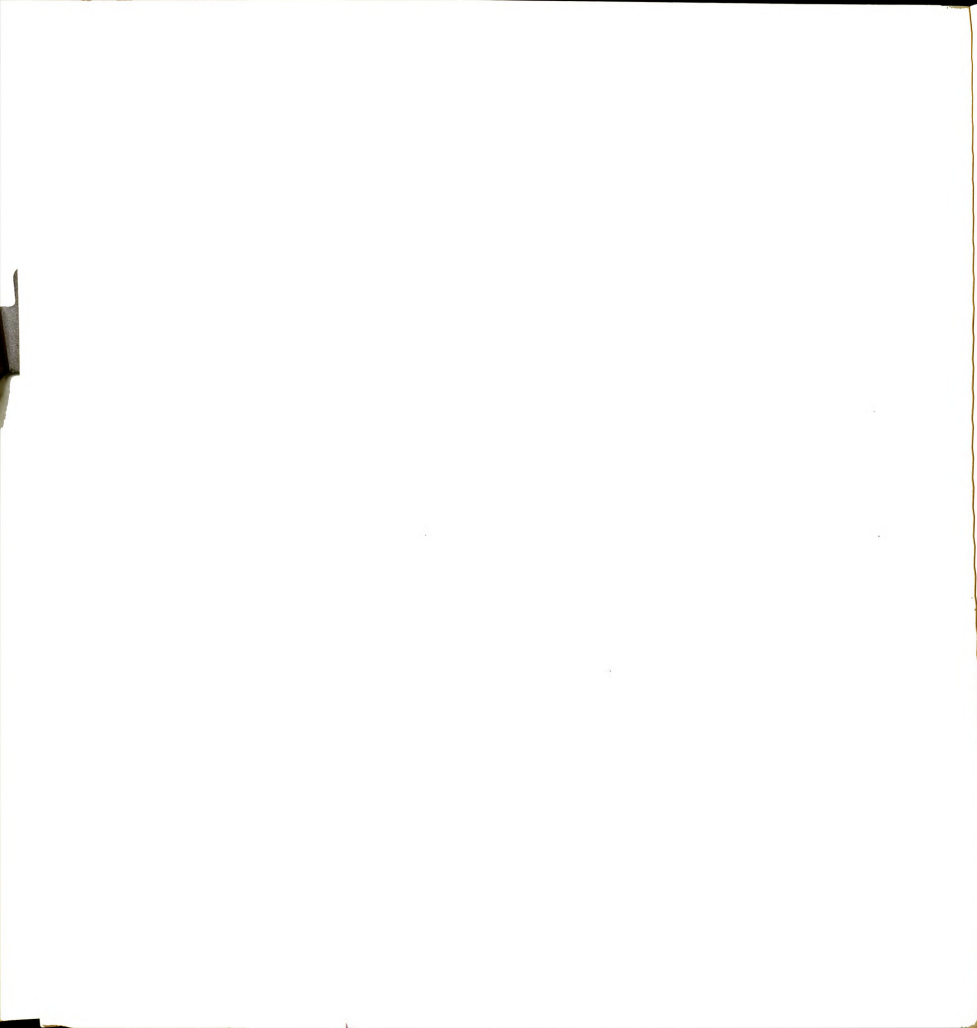


TABLE 5.6. Costs of Supplying Warehouse Space by 1974-75.

Regions	Warehousing Capacity (in Square Feet)	Warehousing Cost	
		(in Rupees)	(in Dollars)
Region 1	512,770	10,255,400	2,154,498
Region 2	1,092,540	21,850,800	4,590,504
Region 3	962,480	19,249,600	4,044,034
Region 4	814,100	16,282,000	3,420,588
Region 5	53,070	11,061,400	222,983

Note: Data in the previous table was further used to derive warehousing cost.



controlled pricing system in order to encourage more efficient utilization of warehousing capacity. From a practical point of view, an orderly system of fertilizer transportation and physical distribution can prove unsuccessful without an efficient scheme of warehouse location. In addition, the public sector lacks adequate resources to finance such a large scheme of warehousing. It would, therefore, be desirable that the participation of private fertilizer distributors be sought to ensure efficient capacity utilization with considerable policy direction from the government. Thus a system of warehouse financing at concessional rates must be organized to meet the loan requirements of the private sector.

Conclusions

The three aspects of physical distribution have been tied together in terms of: (1) institutional, (2) transportation, and (3) warehousing, because of the pseudo-complementarity that exists between them. Since the simultaneous development of the three aspects of fertilizer distribution is necessary in order to attain a certain level of efficiency, a critical minimum effort in terms of adequate financial resource allocation must be undertaken to keep the new scheme of fertilizer distribution going.



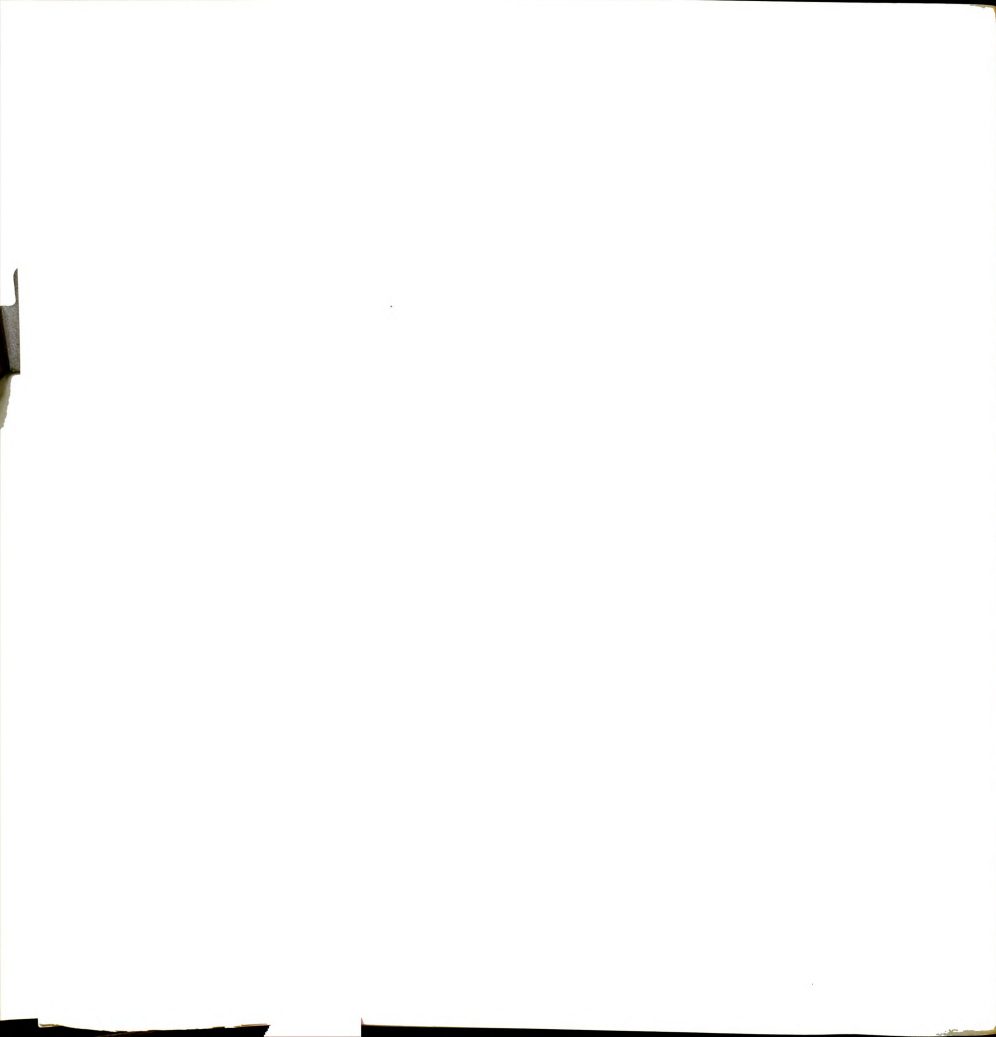
CHAPTER VI

THE PROCESSES OF FERTILIZER ALLOCATION

Introduction

The purpose of this chapter is to examine the role of the government in influencing the market behavior of fertilizer supply and demand and the economic activity of fertilizer distributors. It delineates the existing system of fertilizer allocation and its compatibility with the fertilizer operations of private enterprise. It stresses the need for a shift from a system of comprehensive controls to reliance on free market operation.

In contrast to free market operation where the price system guides and directs the allocation of goods and services into uses consumers value most, the exchange system typified by the conditions in West Pakistan is governed by administrative order and exchange rates that tend to be variable at the discretion of governmental authorities. In the western region of Pakistan, as in other underdeveloped countries, an important instrument of economic growth is the institution of conscious economic planning which represents an attempt to improve the allocation of the community's resources for given social



purposes. These social purposes must be related to the resources available and the need for their realization. The government as an agency of informed social purpose and as the main executive authority exercising its control on such scarce resources as foreign exchange greatly influences the course of action for both public and private sectors. In addition, the government as a competing or complementing entrepreneur acts as the director of economic activity. Key decisions concerning production, consumption, distribution, investment, and almost all socio-economic relationships are made by the government through a hierarchy of civil servants. It enunciates the targets to be achieved in various sectors of the economy and directs resources towards the fulfillment of those goals. Thus economic decisions made by the government officials tend to a considerable extent replace the market determination of prices of some such scarce products as foodgrains, chemical fertilizers, and irrigation water, etc.

In the distribution of chemical fertilizers in West Pakistan the major determinant of goods allocation is government. The fundamental factor differentiating allocation under such government planning from that occurring in a free market is the attempt under government control to consciously determine the apportionment of specified quantities of fertilizer to particular groups of consumers in designated areas of the province. This

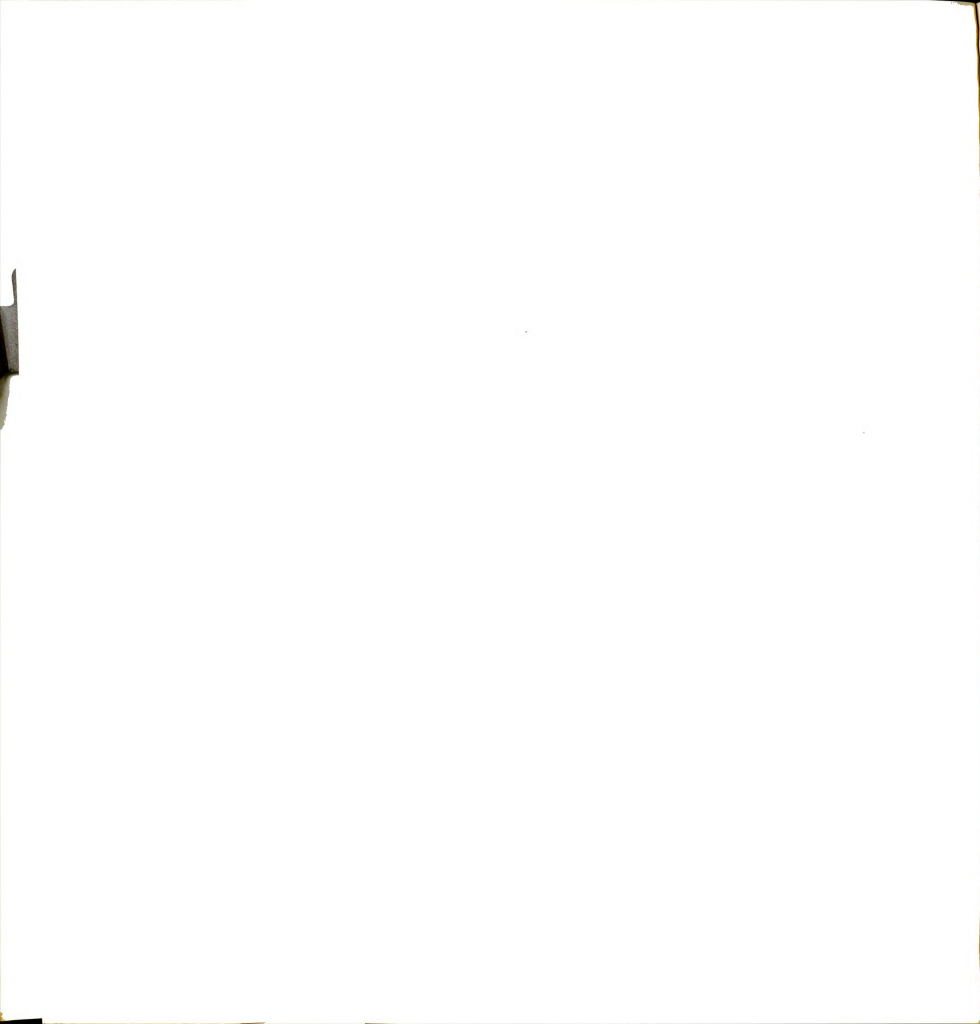


planned conscious determination of allocation embodies a sequence of related activities all of which are directly oriented to the purpose of achieving specific consumption goals derived from the five year plan to be implemented. Economic planning in relation to chemical fertilizer has been accomplished by such measures as allotment, choice of distributive outlets, setting of prices, and sales terms. Government action in fixing these marketing variables inevitably results in removing considerable areas of decision-making from the hands of private entrepreneur. The government as an allocator of resources makes some crucial decisions and performs certain functions for the allocation of fertilizer to various distribution agencies.

The Allocative Functions of the Government

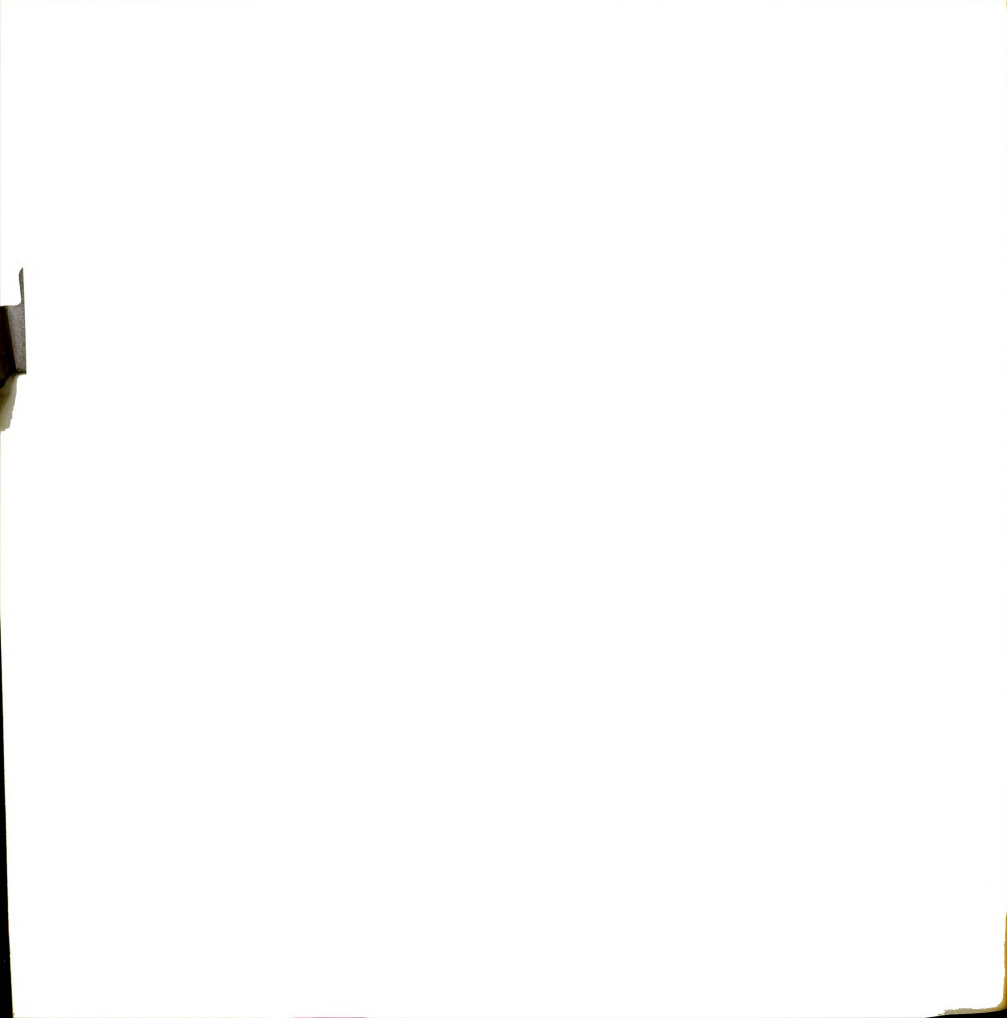
In the process of making fertilizer allotments, the provincial government makes vital decisions concerning fertilizer distribution through the Fertilizer Review Committee consisting of high ranking officials of the provincial government--Planning and Development Department, WPIDC, Cooperative Department, and representatives of other distribution agencies. Apart from developing consumption and distribution goals, the Fertilizer Review Committee is responsible for the determination of specific quotas and making of allotments to specified users. The decision-making body of the provincial government as referred to above, bases fertilizer requirements for the

next year on assessment of fertilizer consumption in the previous year and a desired rate of increase in consumption. The magnitude of fertilizer imports is, however, determined on the basis of expected fertilizer supply position at the end of a current year, the anticipated availability of indigenous fertilizers, and the projected level of fertilizer demand. The goals for fertilizer consumption are derived from the five year plan and the process of determining fertilizer targets is essentially based on the food and cash crop production and associated complementary inputs that would be required to achieve the targets. Thus fertilizer targets would be based on the total cropped acreage. Fertilizer dose per acre for various crops, farmers' level of income, and size of holdings and the cropping pattern and intensity of cropping. If the plan targeted fertilizers are much higher than the fertilizer distribution estimates determined through the system of indenting, the provincial government will either try to reduce fertilizer targets or revise the fertilizer distribution plans of various agencies upward. Fertilizer allotment is made by the decisions of the Fertilizer Review Committee which takes into account broad agricultural policy issues like the acreage to be brought under new varieties, their fertilizer response coefficients, availability of complementary inputs, the strategic areas of fertilizer distribution, availability of agricultural credit, and transportation facilities.



The provincial fertilizer targets are further sub-divided into divisional and district-wise quotas and fertilizer distribution agencies are allotted quotas in accordance with their capacity to distribute, the market share, and indents of the agency. In spite of the regional allocation of fertilizers to various distribution agencies, farmers are free to purchase fertilizers for cash from the dealer of any fertilizer distributing agency without any restriction in inter-district or inter-divisional movement. Since the geographical cost differential for the movement of fertilizers is much higher than the local prices, it tends to be inhibitive unless the stocks of fertilizers in a district are completely exhausted and some farmers can afford to use fertilizers at even higher prices. Through the process of fertilizer allotment, specific quantities of fertilizers are earmarked for the groups of farmers in designated areas. However, there is no system of making allotments or rationing of fertilizers to specific farmers. Any "bona-fide" farmer may come forward and purchase fertilizers from a government authorized or private dealer for cash at a fixed retail price unless fertilizers are deliberately withheld, hoarded, or black marketed by the private dealer against the sanctions of the government.

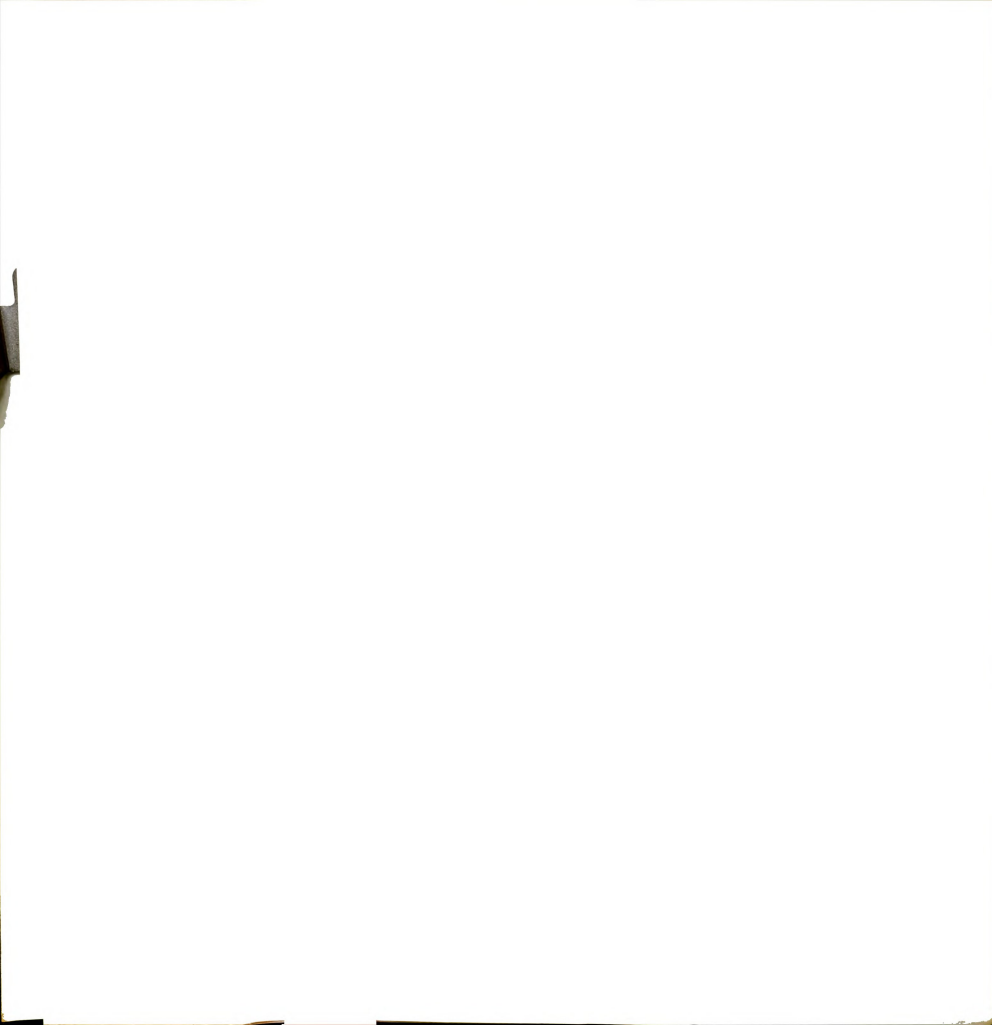
A facilitating aspect of the allocation function is the choice and consequent authorization of distribution



agencies to distribute fertilizers. There are two levels of choice:

1. The designation of specific fertilizer distribution agencies.
2. Their economic viability and ability to distribute fertilizers at the farm level.

The choice of a fertilizer distribution agency whether public or private is a matter of expediency to the government officials. The basic orientation towards cooperatives has, however, in numerous cases resulted in some form of discrimination against private fertilizer distribution agencies. But as a matter of public policy, the preference is given to the private enterprise for the distribution of fertilizers in order to do away with the traditional bureaucratic inefficiency which is characteristic of public distributing agencies. While the government gives a broad direction to fertilizer policy, fertilizer distributing agencies have a freedom in the choice of private commission agents and retailers. The very act of choice of a specific distributing agency also shares with fertilizer distributors the main burdens of carrying on propaganda for the furtherment of fertilizer use among farmers providing sufficient distributive outlets and warehousing facilities and to some extent the administration of fertilizer credit to farmers--in short, doing the bulk of work necessary to expand an underdeveloped market. Since all these aspects of fertilizer distribution



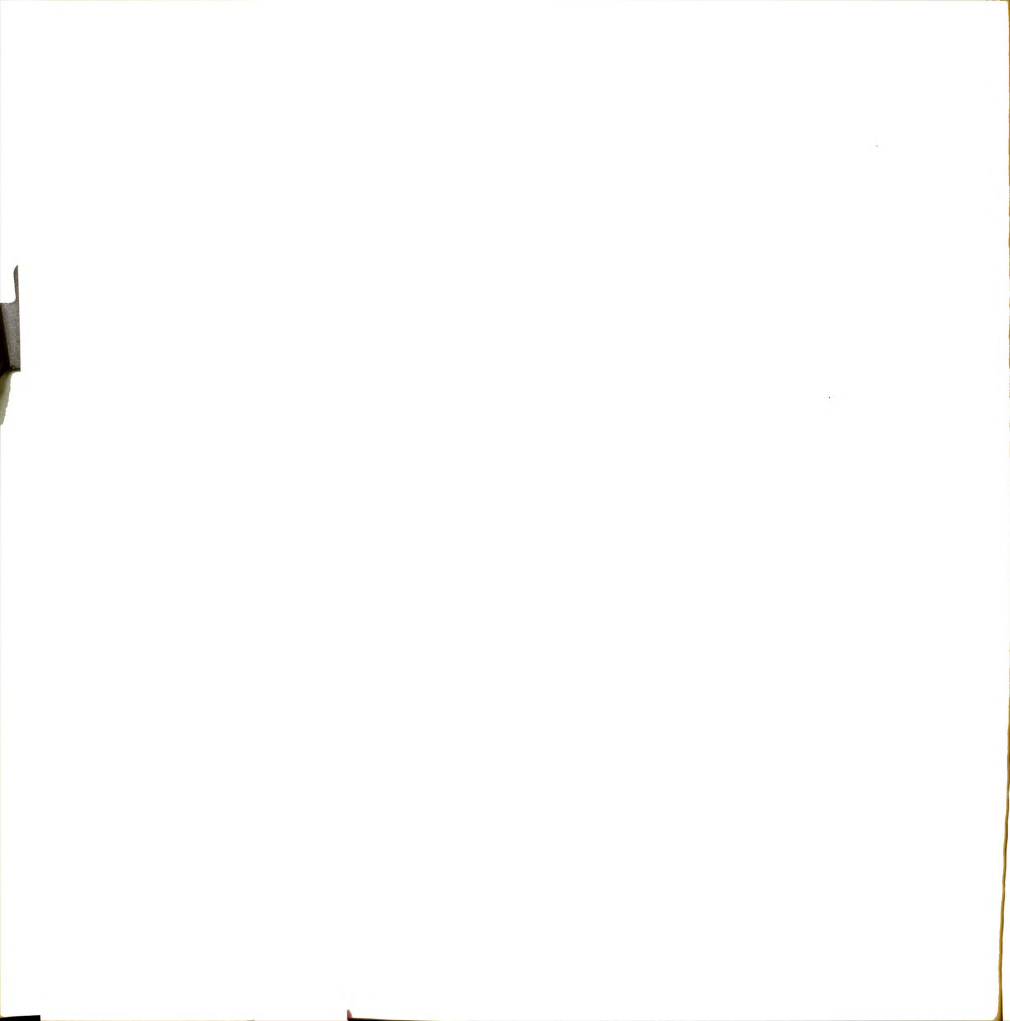
present problems of considerable magnitude to the government officials, their views of allotment are, therefore, to a great extent conditioned by the nature of these problems and the progress that has been made by the fertilizer distributors in solving them. Faced by day-to-day problems of these sorts, the position of the fertilizer distribution agencies is often that of a reluctant buyer facing an aggressive seller. The subject matter of negotiations between the government officials and the fertilizer distributors would, therefore, not be price or sales terms, but the quantities of fertilizer in terms of distributive shares, the types of fertilizers available and demanded by the farmers, and the marketing margins plus haulage costs.

The role of government is supposed to extend beyond the mere process of fertilizer allocation in order to supplement an inadequate marketing system which stems from a variety of factors including the low income of those constituting the largest potential market for fertilizers, inadequately developed physical resources, and a low level of development of marketing services. Since the farmers lack adequate resources for the expansion of fertilizer market, it devolves upon the marketing system, i.e., manufacturers and distributors of fertilizer to provide resources for the stimulation of such developments. Thus an assessment of the economic viability of a fertilizer



distributing agency would be necessary to qualify for floating an organizational structure with a minimum economic size unit for the distribution of fertilizers. It must have an adequate financial base to maintain a certain level of fertilizer inventory, marketing experience, and entrepreneurial talent in order to make its business a success. Thus a minimum level of financial security would pre-qualify a firm to launch its fertilizer distribution program.

An important aspect of the allocative function is the process of making requisitions of fertilizer by the distributors. The activity of making requisitions includes the process of passing on requisitions from retailers, wholesalers, and distributors to the officials of provincial government. The requisitions are in line with allotments planned for the various political sub-divisions. Eventually the requisitions are passed on to the Ministry of Agriculture in the central government which, in turn, assesses the domestic fertilizer production capacity, arranges for foreign exchange allocation with the Ministry of Finance, and issues shipment instructions to domestic fertilizer factories as well as to port authorities. Since the WPIDC is responsible for the indigenous production of fertilizers, with the exception of a few private producers, and the WPADC arranges for the import of fertilizers, fertilizer distributors can obtain their supplies at f.o.b. mill prices from the aforesaid sources.

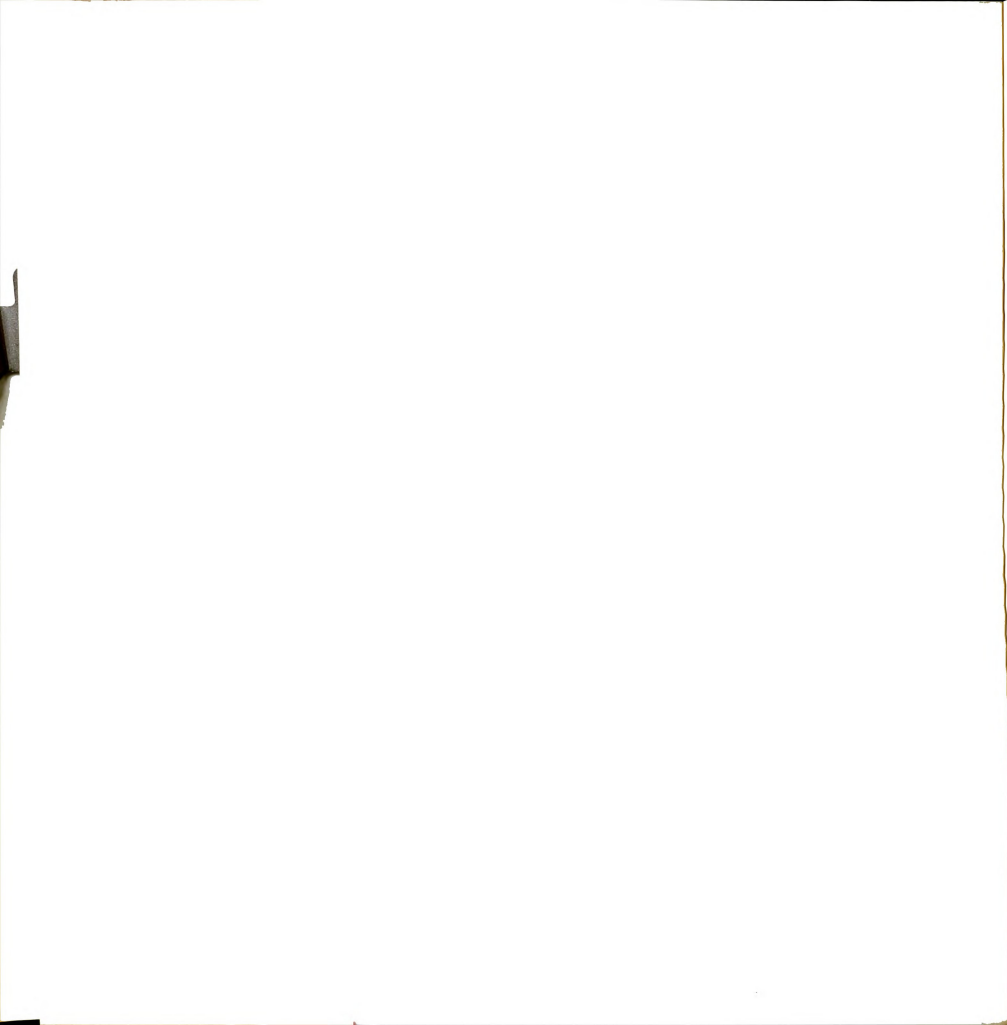


Conflicts in the Process of
Fertilizer Allocation

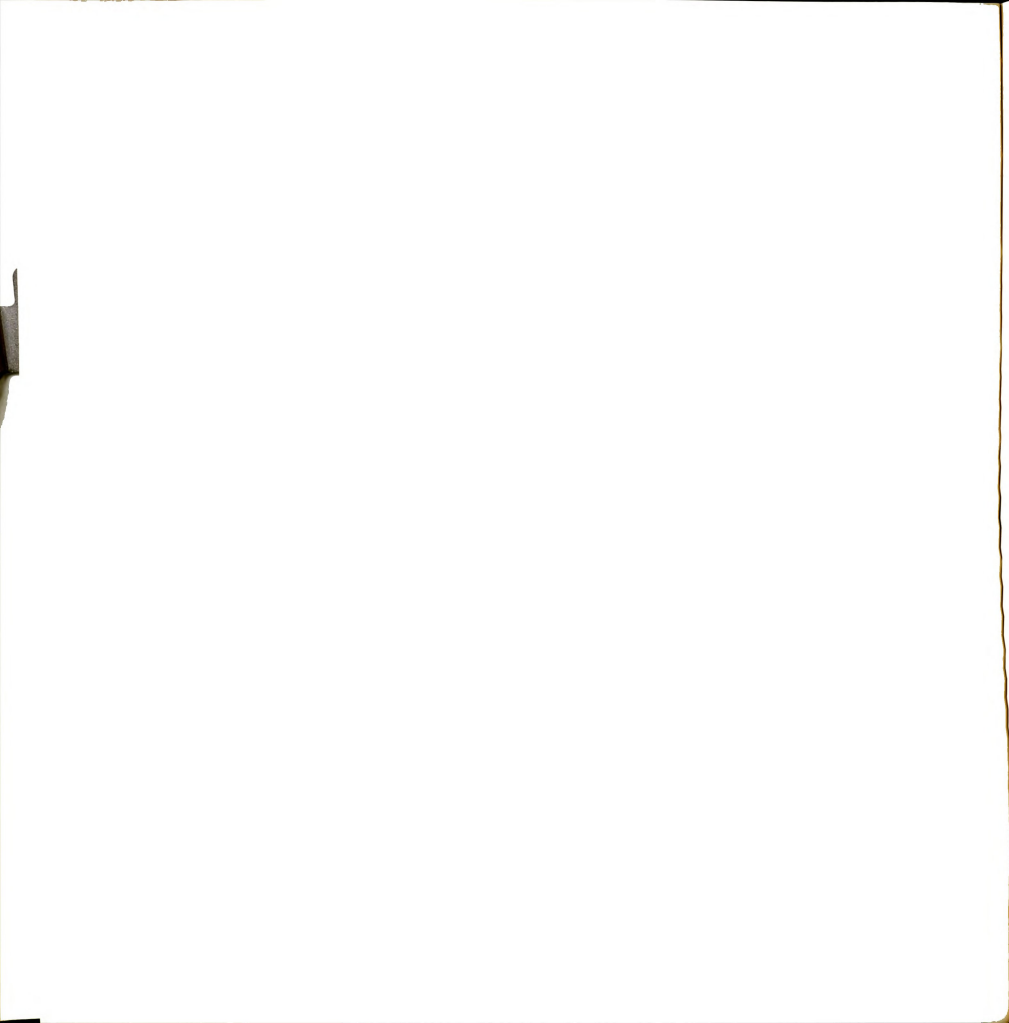
The two major sources of conflict in the allocation of fertilizers are:

1. Conflicts arising from the allocative function of government in relation to fertilizer distribution agencies.
2. Economic planning as a source of conflict.

The basic conflict in the process of fertilizer allocation arises because of the existence of almost complete control of fertilizer at the higher stage of ownership of the channel and diverse types of distribution agencies at other levels of the marketing channel. The stronger bargaining power of government officials vis-à-vis the fertilizer distributors leads to the imposition of publicly conceived ivory tower ideas on the distributors whose work is concerned with what goes on in the field. Problems arise primarily in connection with the fertilizer distributing agencies whose requirements for fertilizer tend to vary with their performance, future plans, and the greater rate of growth in the demand for fertilizer. The planned fertilizer targets are based on the broader considerations of targeted crop production, anticipated fertilizer absorption capacity, and foreign exchange availability. An interesting fact is that the targets based on tentative absorption capacity tend to be much higher than the aggregate requirements of fertilizer

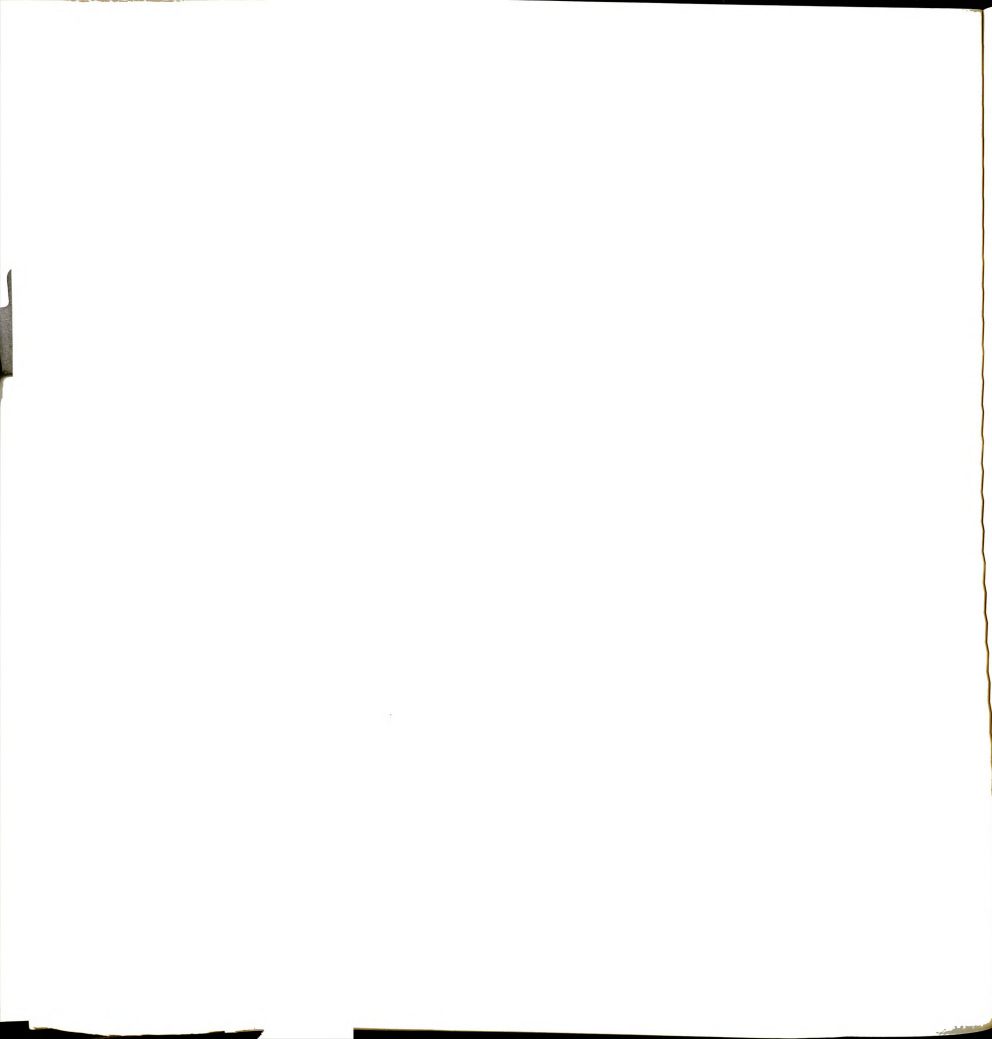


distributing agencies as well as their capacity to dispose of a given volume of fertilizers. Since the officials of the provincial government are extremely concerned about the attainment of fertilizer targets derived from the plan, their views of the size of allotment are most closely related to the implementation of official policy rather than to the problems of individual distribution agencies which they encounter in the actual sale of fertilizers. The conflicts, however, emerge when the government officials do not allow for adequate expansion of transport handling capacity while planning for a desired expansion in the fertilizer distribution. It would, however, be desirable if a coordinating mechanism is created between the transportation and distribution sectors by involving the officials from transportation department in Fertilizer Review Committee. Since the quota of fertilizers to be distributed by an individual distribution agency is allotted much ahead of time before the actual distributive activity takes place, there is a possibility of the emergence of intra-channel deficits and surpluses from the allocated quantity of fertilizers. Since the existing system of channel organization does not provide for the inter-firm flow of fertilizers, the allocation process may result in the inefficient use of fertilizers. In addition, the system of fertilizer allocation does not provide incentives for the incorporation of cost-increasing



technical changes, qualitative factors, and services, because of the fixed retail pricing system.

Since 1955, the beginning of the first five year plan, economic planning in West Pakistan has considerably replaced the market determination of the sale of fertilizers and their prices. The program of allotments is to a considerable extent a substitute for the private enterprise supply-demand-price method of determining how much of an item was distributed, where, and to whom. The program of fertilizer allotments has not only resulted in an abrogation of the immediate supply and demand considerations, especially as they are viewed by a private entrepreneur but also tends to force the consumption of fertilizers in the direction desired by government officials and planners. The government action in fixing these marketing variables inevitably results in removing considerable areas of decision-making from the hands of private entrepreneurs. In such a situation of planning, the entrepreneur is implicitly expected to "fit in" with decisions made at other levels. The process of "fitting in" involves the quantity of fertilizer, purchase price, and resale price that are set by others. The particular levels at which government fixes quantities and prices reflect some concept of social optimum which may well be valid for the nation as a whole, but might not be valid from the point of view of an individual entrepreneur. Since for an individual entrepreneur's acceptance of



government-fixed conditions is a precondition of his participation, he must decide for himself, if the income potentialities are sufficiently attractive. Thus, for those who are risk-takers the opportunity to expand in different directions may be limited. Economic planning results in substantial shifts in the marketing pattern with respect to the classes of buyers and the geographical areas served. The program of allotments tends to force "consumption" in directions indicated by the social objectives of planners. Thus, a problem that could be solved through competitive buying in more purely private enterprise environments may be decided by administrative order with quite different end results.

A conflict is, however, introduced by the public planning of market distribution primarily because it replaces private decision-making with administrative orders and control. In a private enterprise economy the entrepreneur has some power to manipulate certain marketing variables such as the products carried, the quantities stocked, the location of enterprise, and prices as well as sales terms. Whereas in an environment typified by administrative order the particular restrictions such as the inability to obtain allotments or to depart from a fixed price are likely to limit his ability to manipulate marketing variables and to respond to a market signal. The character of conflict between government and private



agencies is conditioned by the fact that government occupies a special place in the market, both as an entrepreneur and as government. The government's role as entrepreneur is not dissimilar to that of discriminating monopoly in a private enterprise economy. Given the government's special position as a participant and as a spokesman of public policy, conflicts cannot usually be resolved by direct market interplay. Instead they must be resolved largely through non-market negotiation.

The Processes of Fertilizer Allotment
Versus Private Producers

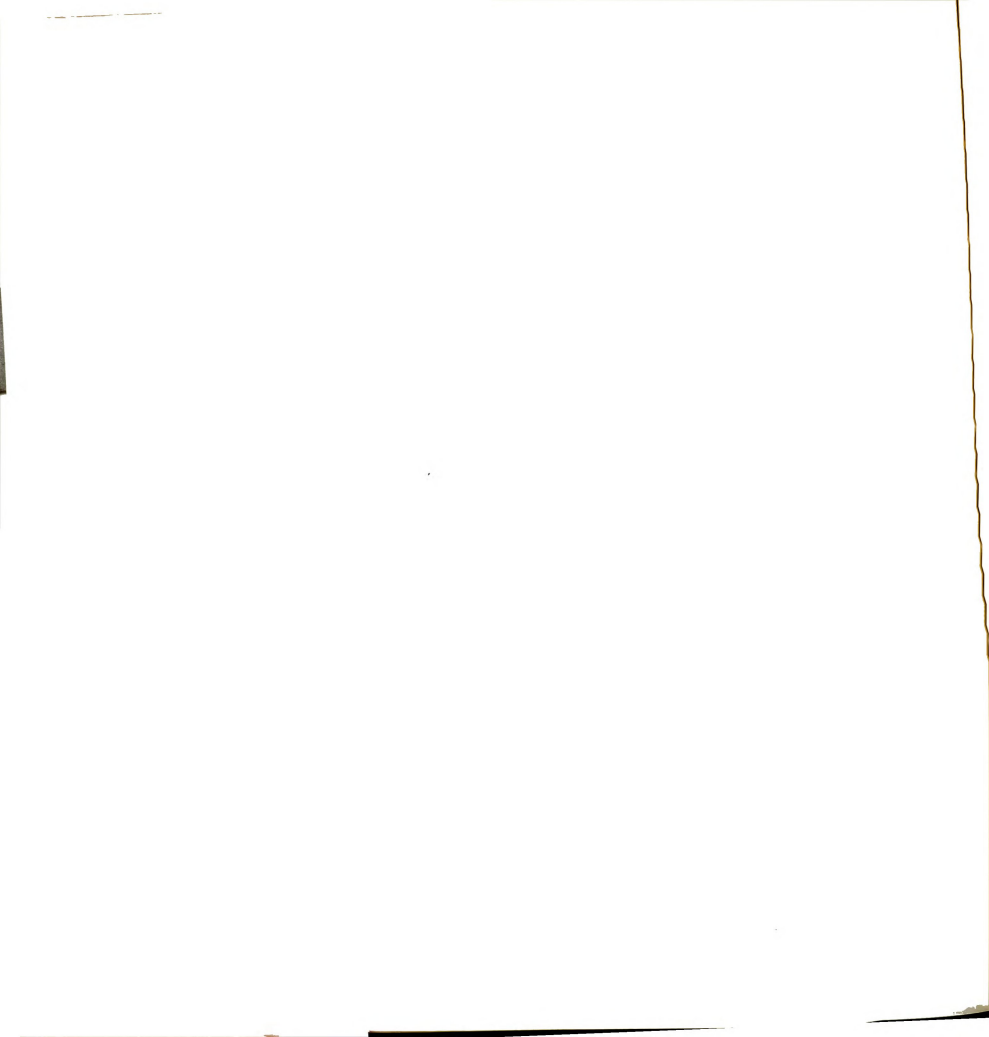
Apart from the WPIDC there are also emerging private fertilizer producers on the economic horizon. For example, ESSO, which started its fertilizer distribution activities with pure dependence on fertilizer imports of WPADC, has begun its own fertilizer production in order to meet its fertilizer distribution requirements. Since it intends to have its own team of agricultural experts and a chain of wholesalers and retailers, the impact of new fertilizer distribution policy would be to eliminate a part of the activity of allotment and allocation of fertilizers from the hands of government. With the participation of new private bodies in the fertilizer distribution system, the economic incentive to vertically integrate backward into production is likely to increase resulting in lesser and lesser fertilizer allotment

activity that passes through government officials. Its immediate consequence will be that government will be left with almost no account of the private entrepreneur's activity and, therefore, with considerably less control on fertilizer distribution policies. Unlike the government's allocative activities, none of the private activities are likely to be directly-oriented towards putting specified quantities of a particular type of fertilizer in designated classes of farmers in given territories, nor would be the market planning of such measures as making of allotments to political sub-divisions. The market behavior of private enterprise is likely to be governed by "wait for orders as they come," and he would not be able to exert pressure on distributors which may be comparable to that exerted by the provincial government.

The compatibility or incompatibility of private enterprise with public policy would depend largely upon:

1. The ability of private agencies to perform marketing functions in keeping with economic goals.
2. The extent to which government regulation and control impede or facilitate the private performance of marketing.

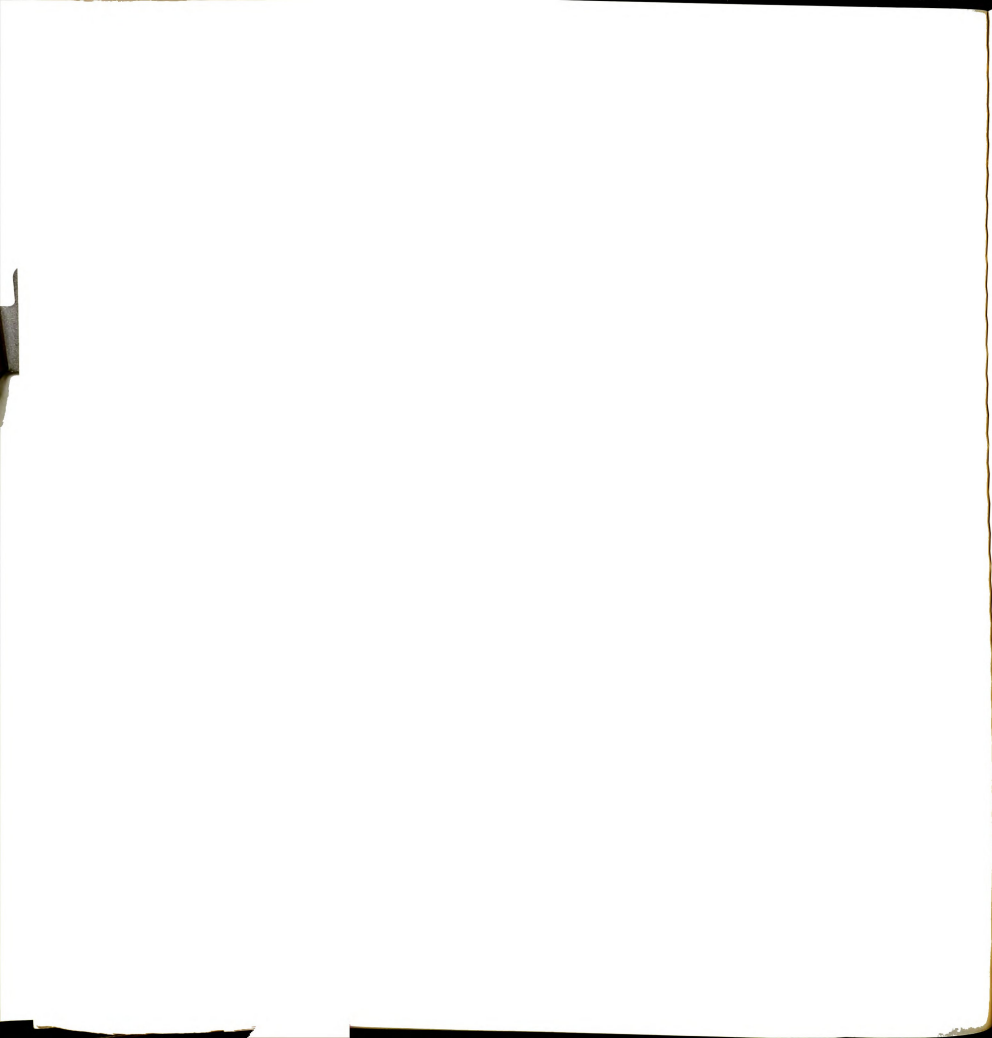
Under the existing system of fertilizer distribution, the viability of a fertilizer distributing agency would depend to a large extent upon the latter's ability



to expand the market in desired social goals. To the extent private agencies cease to exercise entrepreneurial functions such as the assumption of risk and development of markets and simply become order-taking agencies, there seems to be little reason for their existence as separate institutions. The sole justification for the retention of a particular type of marketing agency is its ability to perform a function that other kinds of organizations cannot perform effectively.

Conclusions

An analysis of the existing processes of fertilizer allocation indicates that the lack of effectiveness of the fertilizer distribution system is primarily due to a number of exchange rules in the form of fertilizer allotment, quotas and fixed prices which are rather too restrictive to permit an organic growth of fertilizer industry. In addition, the emergence of new private fertilizer producers has led to the belief that the currently operating set of market exchange rules that influence the fertilizer distributive activity are inadequate to govern the operations of private enterprise. A relaxation of the government controls to give a greater leeway to the private entrepreneur would be necessary.



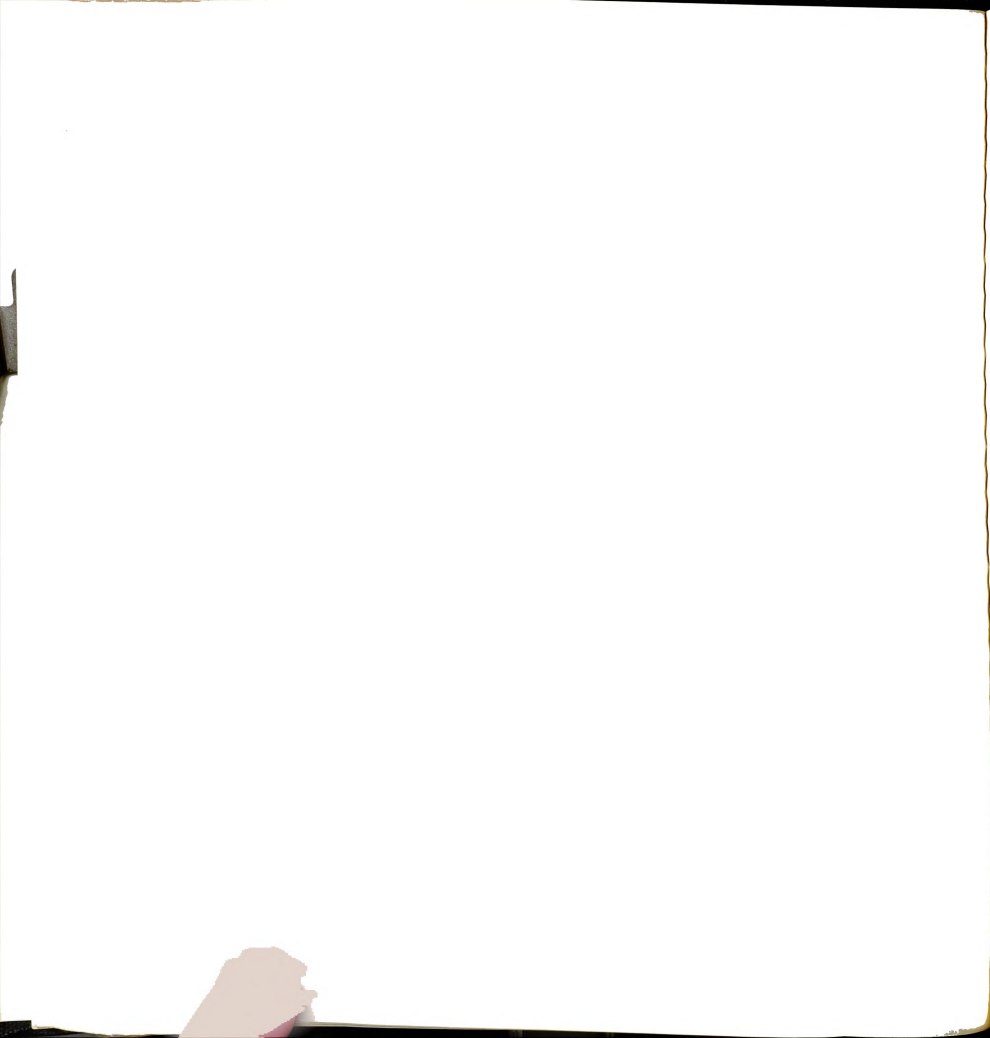
CHAPTER VII

TERMS OF SALE AND PRICING PRACTICES

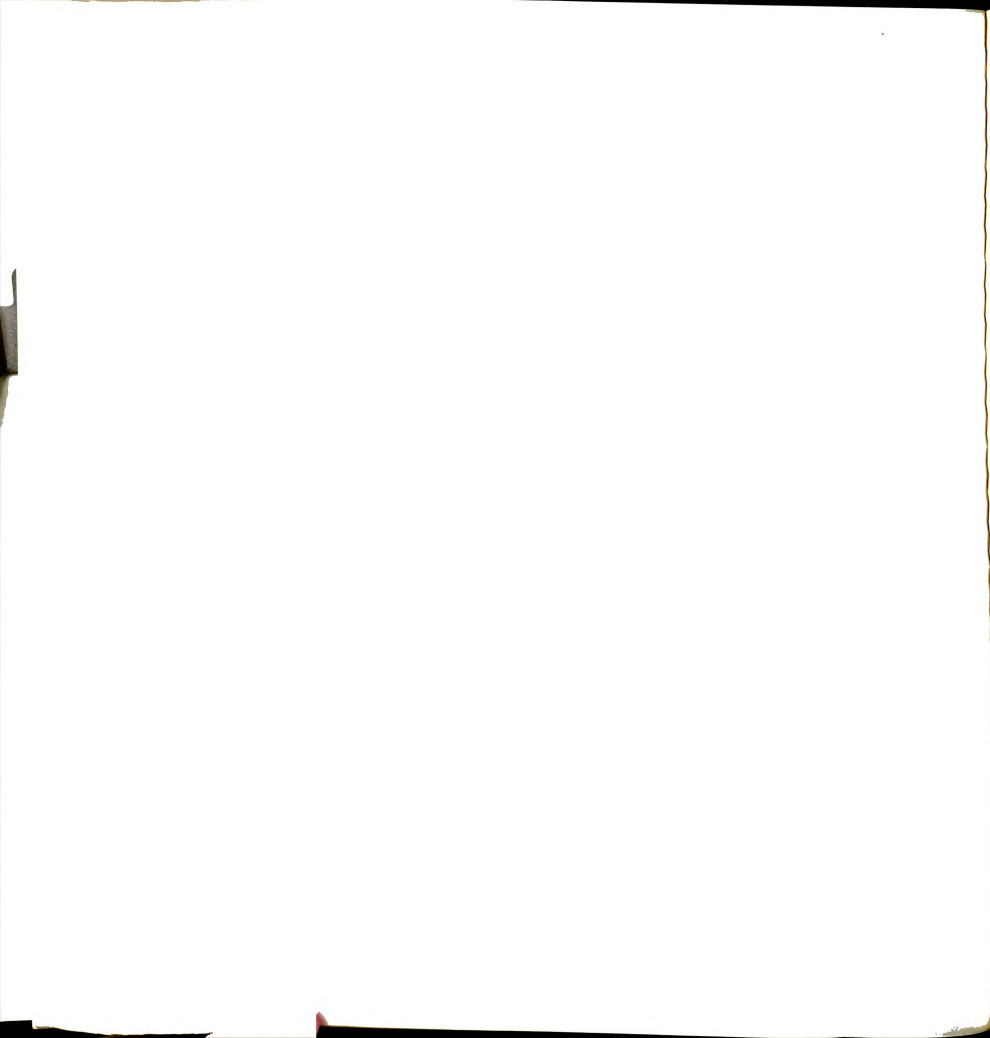
Introduction

This chapter isolates that aspect of fertilizer distribution which relates to the system of fertilizer pricing. It examines the pros and cons of a shift from a system of comprehensive price control to a system of fertilizer pricing which is consistent with free market operation.

The price of fertilizer constitutes an important variable insofar as it influences the level and pattern of production and market resource allocation. Changes in fertilizer price can lead to shifts in the profitability of fertilizer and farmers' economic motivation towards the production of various crops as well as input-output price ratio. Thus, an incentive towards increased or decreased use of fertilizers may either come from bringing about a shift in the physical productivity of fertilizer or from improved fertilizer crop price ratio. The shifts in the profitability of various crops are likely due to changes in price, if the ratio in which alternative commodities can be produced with a given set of



resources at the farmer's disposal are very similar to the existing ratio of prices. Thus, small relative price changes under one set of physical production possibilities may induce a change in the profitability of some crops over others, whereas a large relative change in price under another set of physical production ratios with a given resource base may suggest a different combination of farm enterprises. The fact that fertilizer market in West Pakistan is still in the early stages of development, lack of technical knowledge, conservation, and price uncertainty combine to cause substantial under-utilization as judged by the exposte relationship of prices. The rational economic argument for subsidizing the price of fertilizer is that farmers in effect, tend to overdiscount the returns to fertilizer as compared to society due to a number of risks like yield risk, price risk, and weather risk. Subsidized price, therefore, provides a compensating discount that leads to a new, but higher level of optimal fertilizer use. Thus, in order to ensure low fertilizer prices to farmers, the government of West Pakistan provides for a relatively high fertilizer subsidy through a comprehensive set of controls by fixing the prices of fertilizer at f.o.b. mill wholesale and retail levels.



Vertical Price Structure

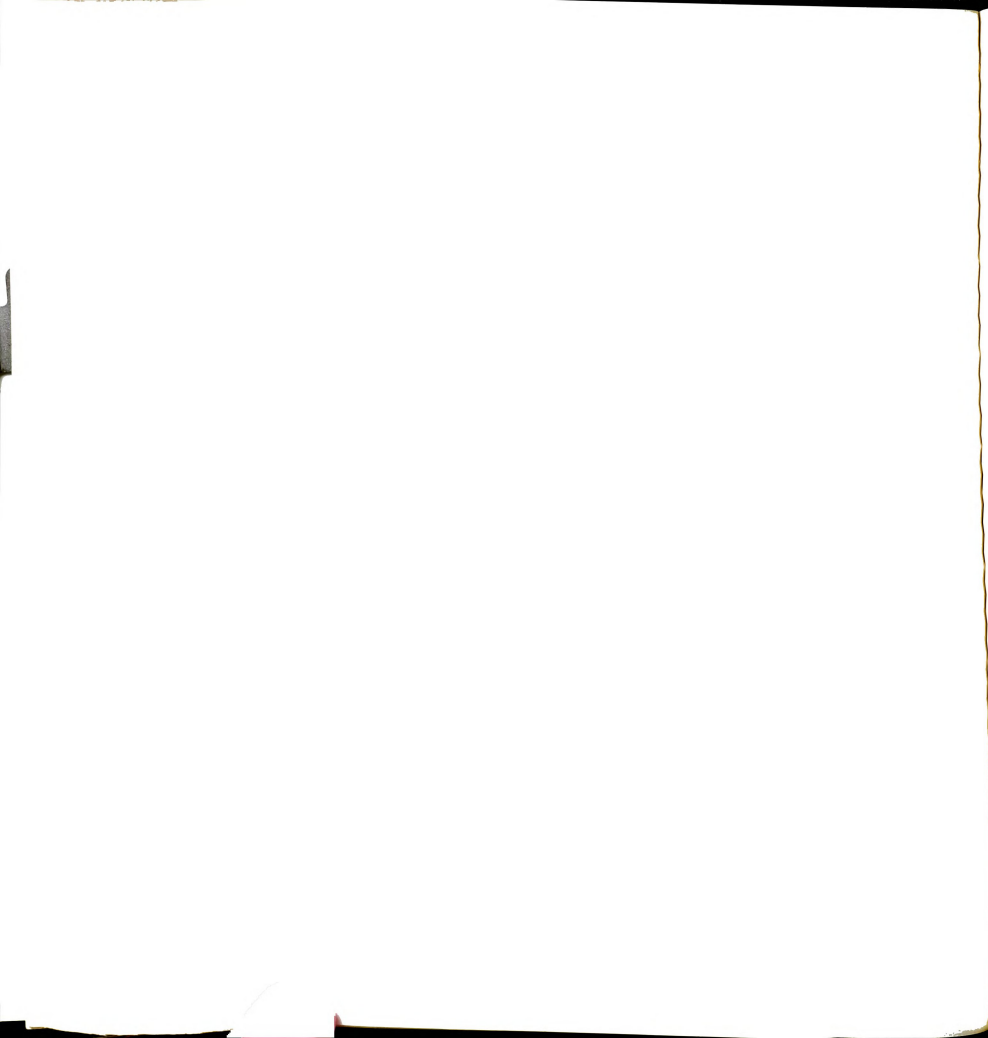
The system of control on fertilizer prices through administrative order stems from the basic policy of fertilizer allotments, target setting, and economic planning.

The broad purposes of this control are:

1. Stimulation of demand for fertilizer by insuring the lowest possible price to small farmers that would be consistent with a "no profit, no loss" marketing operation.
2. Facilitating a more even geographical pattern of consumption by maintaining nationally uniform prices.
3. With these objectives in mind, the government of West Pakistan determines:
 - a. The prices to be paid for fertilizer by the public and private distributive organizations to which it makes allotments.
 - b. A maximum resale price for plantations and other big farmers who intend to purchase fertilizers directly from the government allotments.

The power to set prices for all types of fertilizers, however, rests with the provincial government which determines the retail prices for fertilizer on the basis of a broad criteria which include:

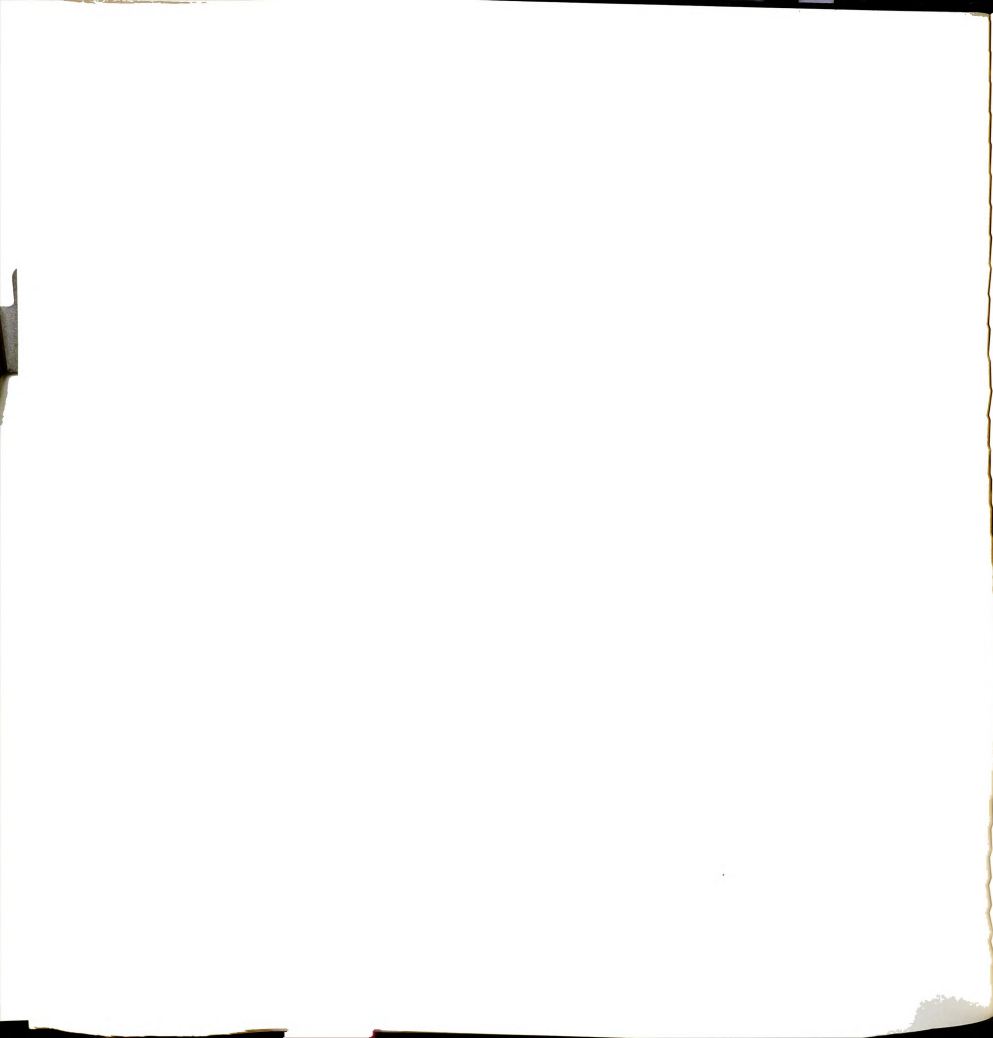
1. Average cost-price of fertilizer purchased from domestic and foreign sources.



2. Average charges for freight and handling from ports and factories to their destinations in West Pakistan.
3. Fixed average marketing margins for intermediaries.
4. Minus the percentage subsidy on fertilizer prices which government intends to advance during a particular year as a measure of broad agricultural policy.

The procedure for determining the marketing margins is based on the calculation of average cost of physical distribution for both the imported and indigenous fertilizers including a provision for distributors' profit between rail station and retail selling points. The cost is computed on the basis of:

1. Cartage charges for an average distance of ten-fifteen miles.
2. Stevedoring, clearing, and forwarding charges for imported fertilizers as well as wharf rent and purchase and inspection costs.
3. Railway freight for inland and up-country transportation of indigenous and imported fertilizers.
4. Warehouse rent.
5. Wages, salaries, and administrative overhead.



6. Sales promotion costs of and provision for unforeseen losses.

7. Distributor's "commission" or losses.

In some cases, actual resale price is fixed at a level based on computations encompassing physical handling costs plus a "commission" for the distributor or dealer. While the marketing margin encompassed in the "commission" may vary with individual firms, it is often analogous to a gross margin between sale price and laid-in cost price, rather than being a payment for specific services rendered. Since the up-country costs for imported fertilizers are higher than those for the inter- and intra-regional movement of indigenous fertilizers, the gross markup on the product cost though low as a percentage of the total, is higher on imported than for domestically manufactured fertilizers as given in Table 7.1.

Terms of Sale

Since the WPADC is the only agency responsible for the import of fertilizers, its terms of sale to private distributors are four months free credit from the date that fertilizer is delivered to them at Karachi. Distributors, on the other hand, demand from retail agents either a cash deposit prior to shipment of the railroad cars and/or full payment prior to the cars being released to the agent at the up-country railroad heading. Similar arrangements exist for the sale of fertilizers produced

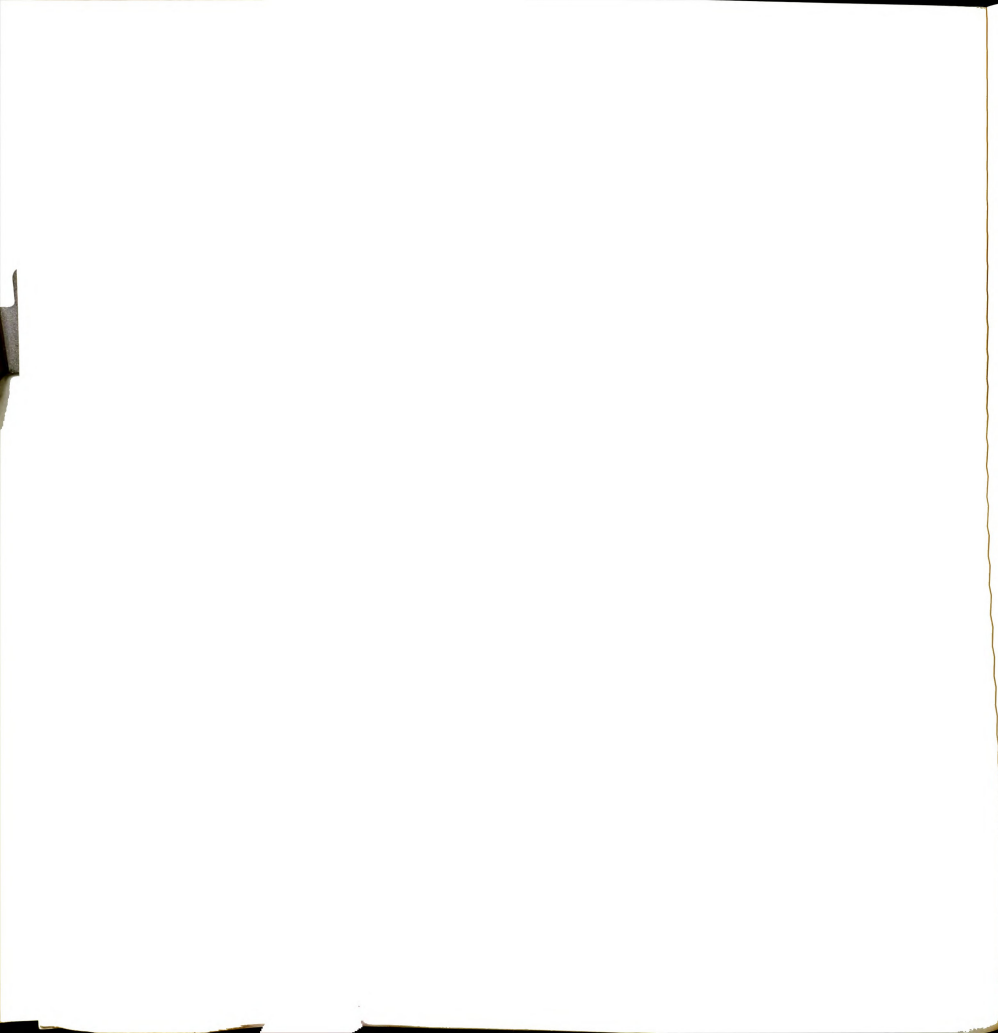
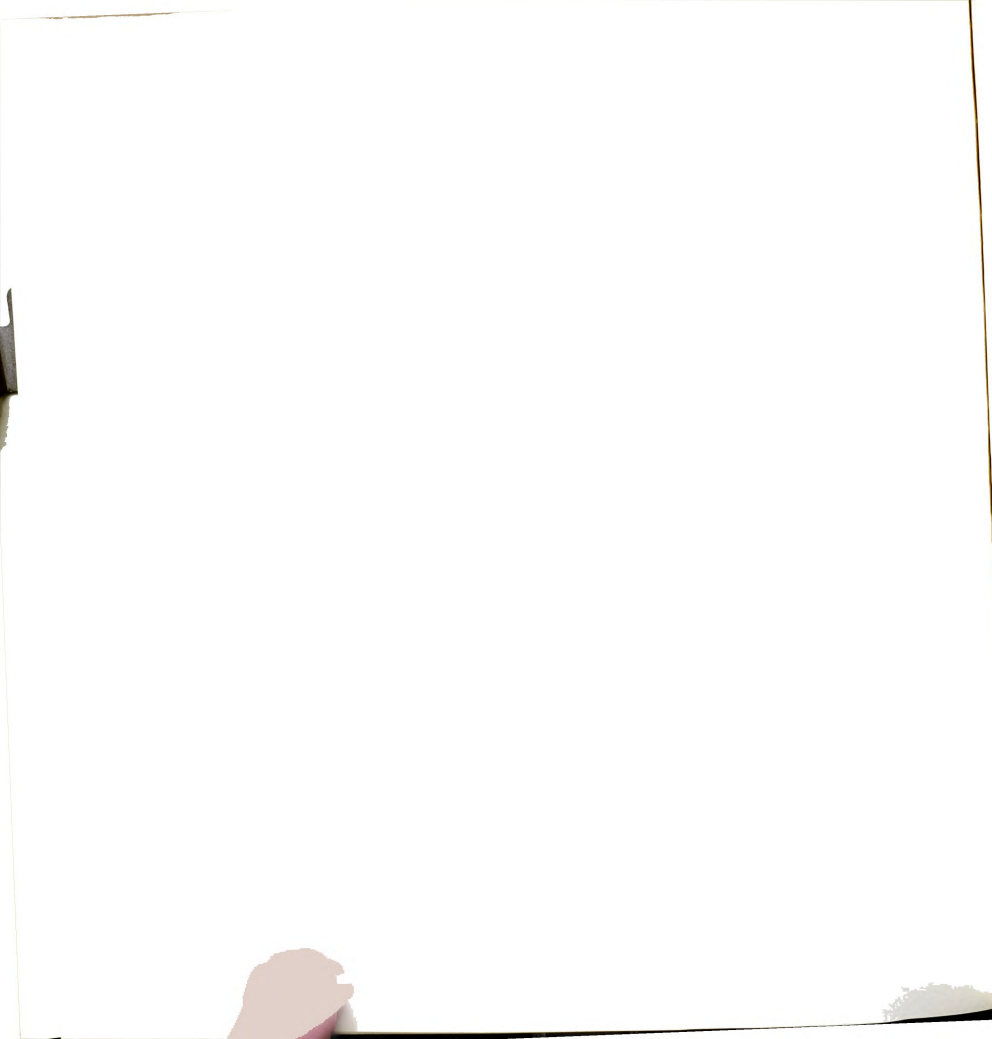


TABLE 7.1. Incidentals on Various Types of Fertilizers (\$ per ton).

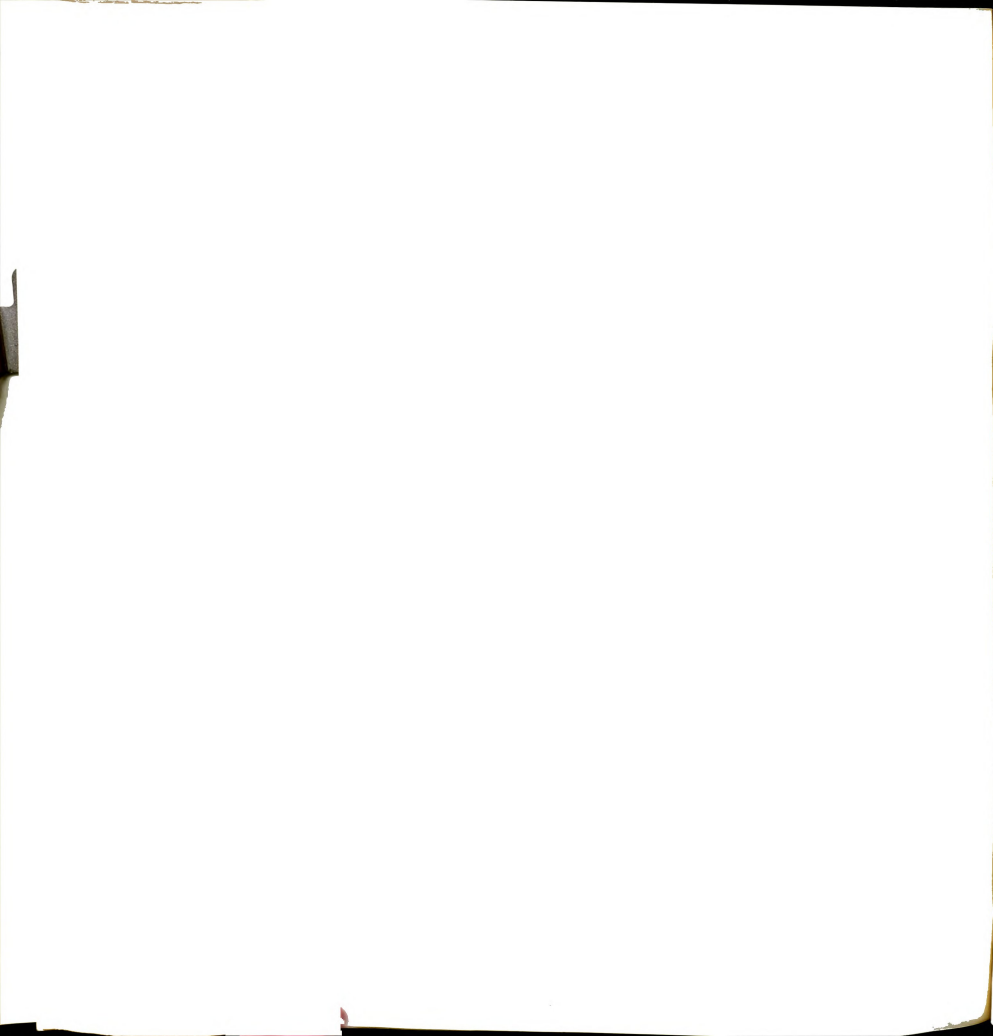
Types of Fertilizers by Sources	1964- 1965	1965- 1966	1966- 1967	1967- 1968	1968- 1969	1969- 1970
<u>Indigenous</u>						
Ammonium Sulphate	6.67	6.67	7.03	12.39	15.13	15.13
Ammonium Nitrate	6.67	6.67	8.39	12.39	15.13	15.13
Urea	6.67	6.67	12.94	16.39	21.22	21.22
Superphosphate	6.67	6.67	7.03	12.18	14.92	14.92
<u>Imported</u>						
Urea	9.19	9.19	9.19	23.11	28.29	28.29
Ammonium Sulphate						
Nitrate	9.19	9.19	10.50	19.12	22.20	22.20
Ammonium Sulphate	9.19	9.19	. .	18.70	. .	. .
Triple Superphosphate						
Diammonium	9.19	9.19	10.50	20.59	25.84	25.84
Phosphate	. .	. .	. .	. .	28.29	28.29
S. Potash	. .	. .	. .	. .	27.45	27.45
Nitro-Potash	. .	. .	. .	. .	22.27	22.27

Source: Unpublished memos issued by the Planning and Development Department,
Government of West Pakistan, Lahore.



y WPIDC to private distributors. The existing system of fertilizer sales takes away a major part of the cash reserves of retail agents and reduces their liquidity position for maintaining adequate inventories or making credit sales to farmers. It is, therefore, necessary that a system of inventory financing or extension of credit facilities to retail agents be evolved. The possibility of conflict, however, arises when the extent of increased costs of storage and repayment is limited by fixed margins.

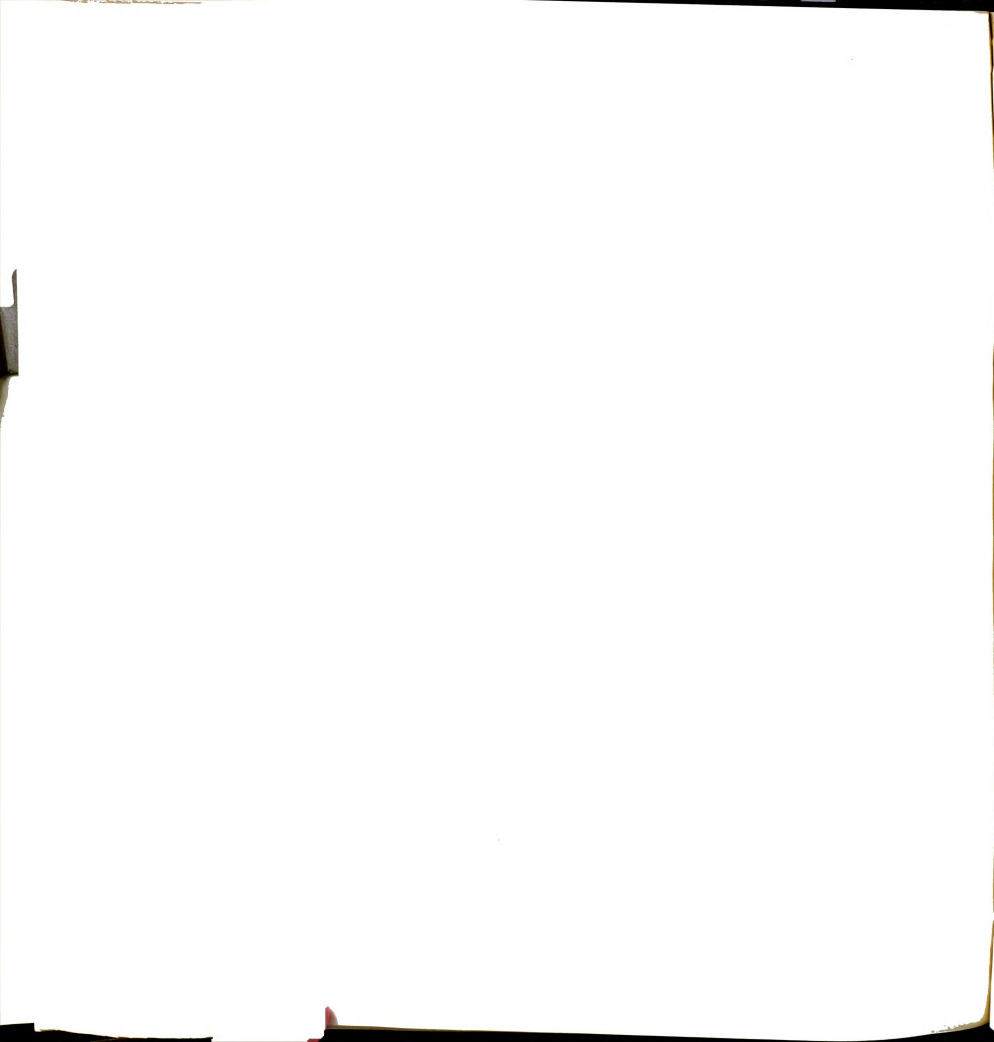
Since the indigenous sources of fertilizer supply are controlled by the WPIDC, a semi-public body which is subject to the rules and regulations of government, the problem of making fertilizer directly available to the private distributors without the sanction of government does not arise. As soon as the privately owned ESSO fertilizer plant and other similar plants came into production, the problem of imposing uniform price control and giving of fertilizer subsidy is likely to assume a new dimension. ESSO intends to have a vertically integrated marketing system enabling the retail agents to sell fertilizers at lower prices than the officially fixed retail price. Similar changes may be noticed at f.o.b. mill and wholesale levels. The structure of fertilizer production would take the pattern of an oligopolistic or monopolistically competitive industry where new tools of economic analysis can be applied. The fundamental factor



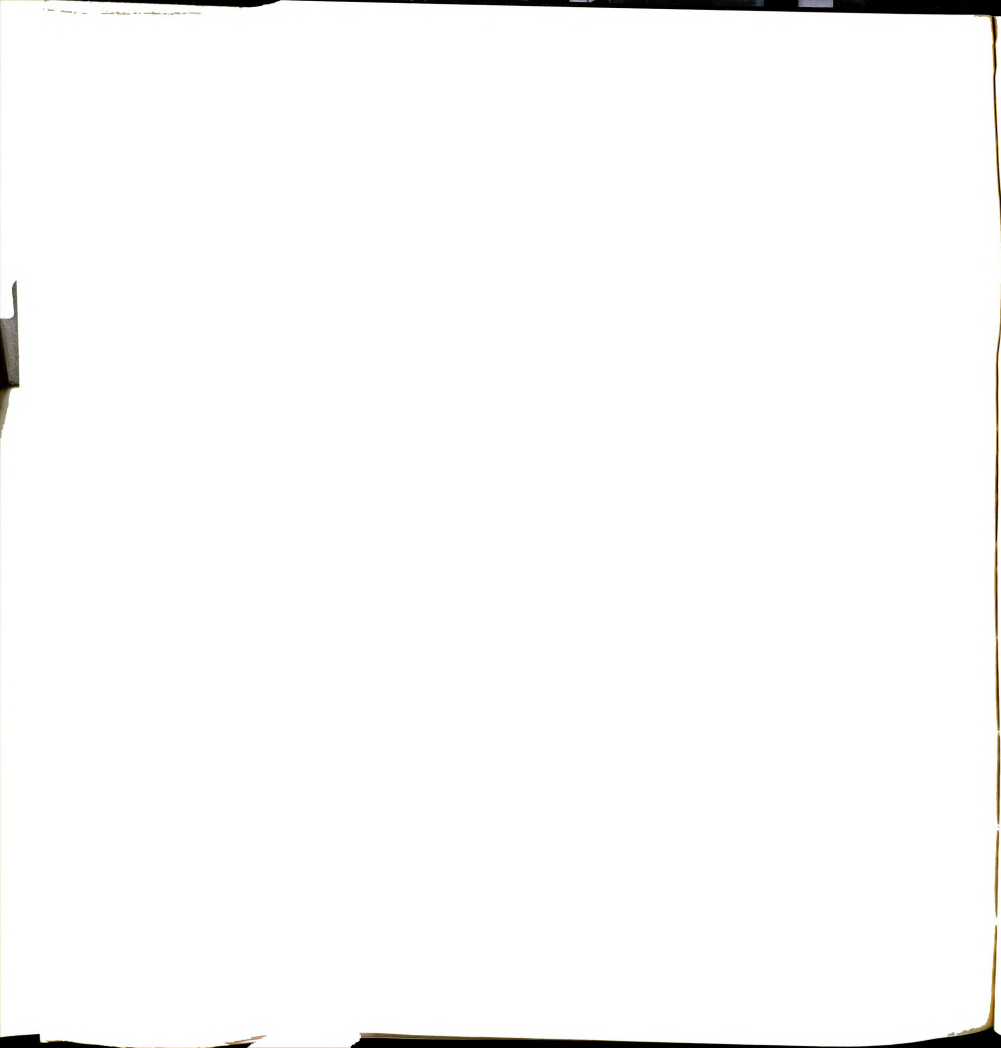
that can be put forth against the controlled pricing system is the maintenance of price control. It is almost practically impossible to maintain an array of vertically fixed prices throughout the year regardless of the temporal and geographical variations that may automatically originate from the market forces of supply and demand for fertilizer at a certain point in time.

An Evaluation of the Current System
of Fertilizer Pricing

The existing system of vertical price relationships as determined through administrative decision-making at the provincial level and in which an individual entrepreneur is required to "fit in" allows the slightest "margin" for him to actively pursue his profit maximizing activities. The basic consideration in the fixation of fertilizer prices is to pass on the full benefits of fertilizer subsidy to farmers while allowing the least possible margin of profit for the distribution sector. It provides a considerable disincentive to the fertilizer distributor to expand his distribution activity beyond the point where his marginal costs begin to exceed the horizontally fixed price. The rationale that each economic system has its own set of market rules within which an activity takes place, loses its ground when the market rules become too restrictive so as to permit profit maximization by the fertilizer distributor to take place at a much lower level than the profit level he would

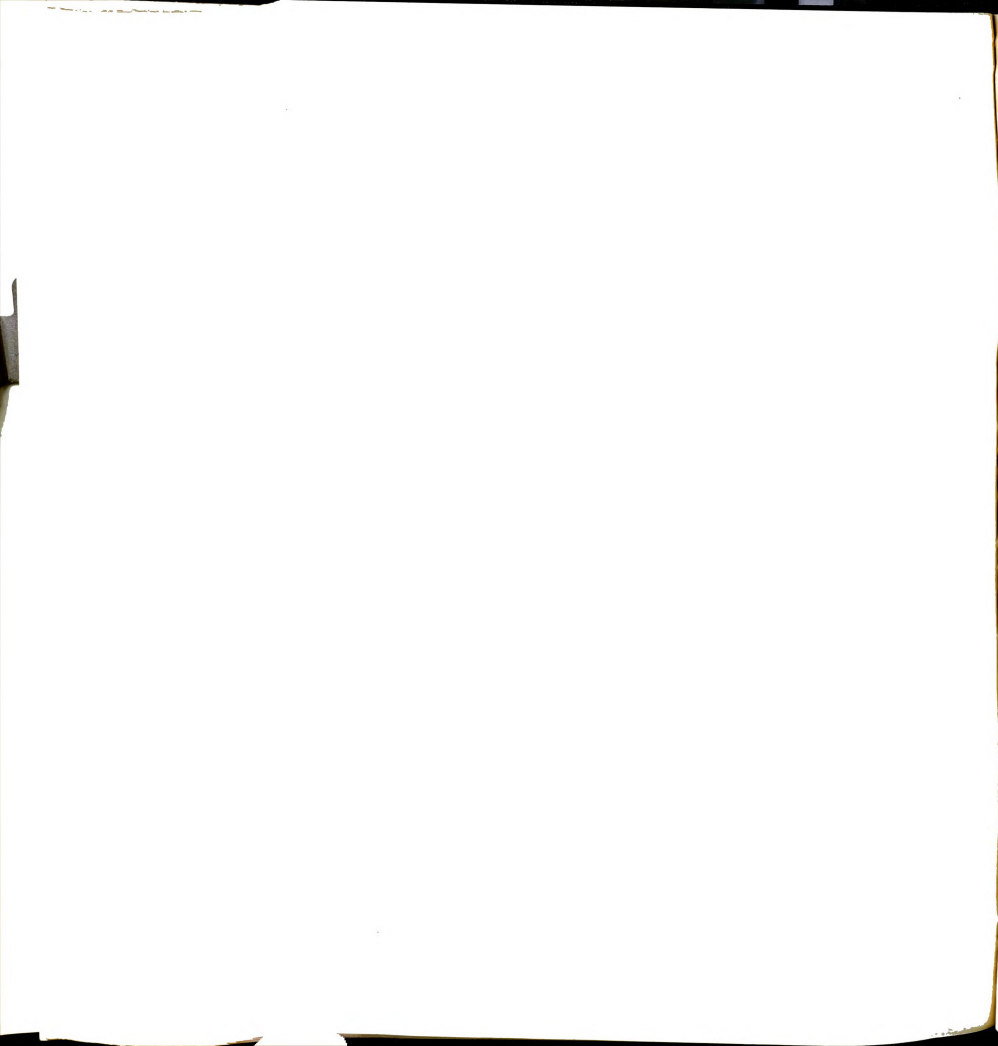


achieve under free market operation. The currently operating system of price controls not only enjoins upon the government to police a wide range of fixed prices but also is costly in terms of economic inefficiency and administrative decision-making which uses up a considerable proportion of the scarce administrative resource. While government officials reflect essentially a pragmatic concern with the problems of carrying out distributive tasks within a specified operational margin the problem of fixed margins props up as an essential "dichotomy of marketing" between planning and policy execution. The concept of "no profit, no loss" distributive operation that seems to lurk behind the structure of fertilizer prices is more apparent than real. At least, it encompasses only the aggregate of physical distribution costs from supply source to the final points of fertilizer distribution which are various railheads. The uniform pricing system of fertilizers all over West Pakistan reflects neither geographical price differentials nor market segmentation which may be based on different classes of buyers. The officially fixed f.o.b. mill prices allow for no price discount allowances, rebates, or cash discounts. Since the demand for fertilizer is seasonal, the institution of "off-season rebates" during the slack season would be necessary in order to maintain an even flow of fertilizers and to tide over the fluctuations in fertilizer production that tend to originate from demand.

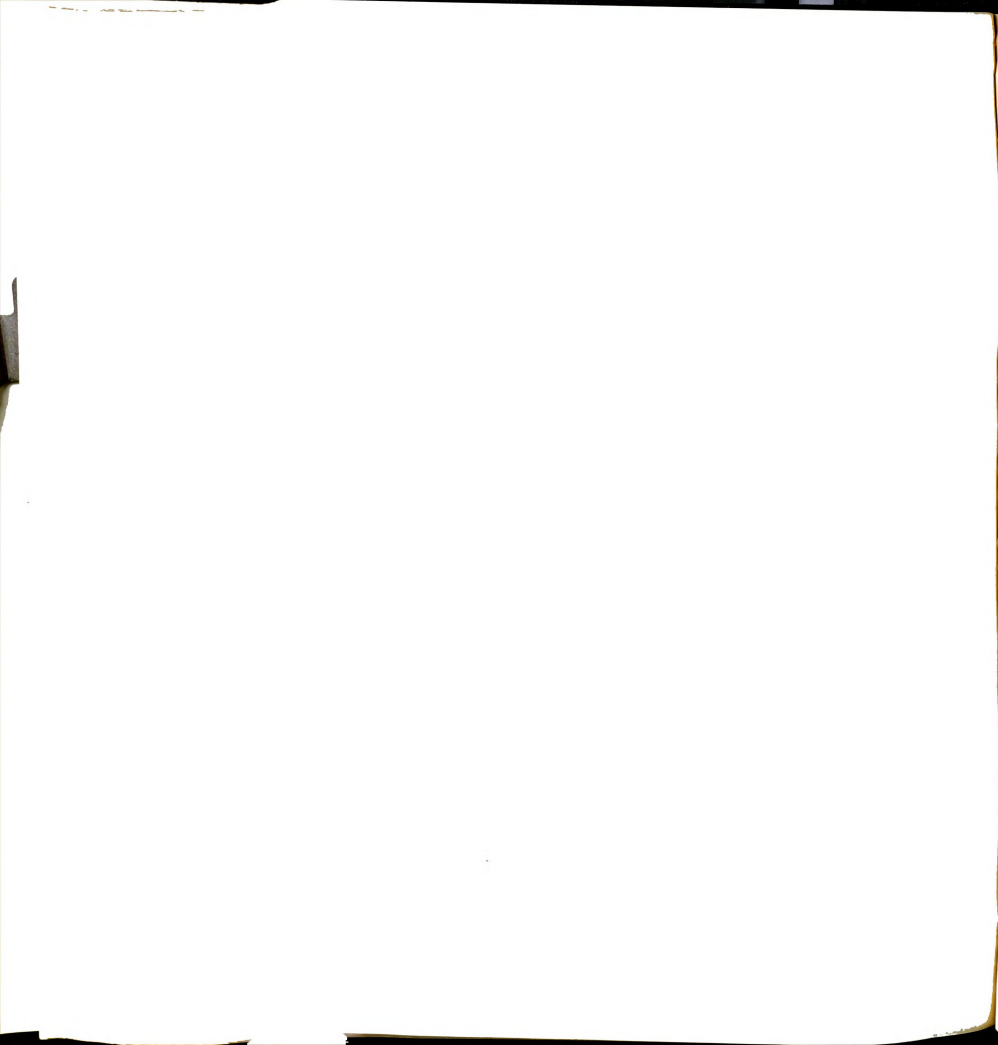


A Proposed Fertilizer Pricing Policy

Since the officially prescribed fertilizer pricing system does not take into account the seasonal pattern of demand and such exogenous factors as may cause unstable behavior of the market, it loses its significance to both the distributor and the farmer. Such a pricing system may imperceptibly erode away the benefits of fertilizer subsidy to the farmer with considerable gain to those who can unscrupulously accumulate profits. It would, therefore, be desirable to allow the free market determination of fertilizer prices. The rationale underlying the system of comprehensive price controls is that the fixed marketing margins act as a safeguard against excessive profits by the market intermediaries and ensure lower fertilizer prices to farmers as well as increase their marginal returns. Whereas the public policy of policing the price system seems to be practically impossible, there exists no such market mechanism that may ensure lower fertilizer prices and smaller price spread. Under a pricing system involving freer adjustment of the forces of fertilizer supply and demand, intra-channel competition tends to restrain excessive marketing margins and keeps fertilizer prices within competitive limits. The discussion as to what type of pricing policy to follow can only take place within the context of channel organization. In spite of the fact that the channel structure proposed in the previous chapter tends to promote a workably competitive environment



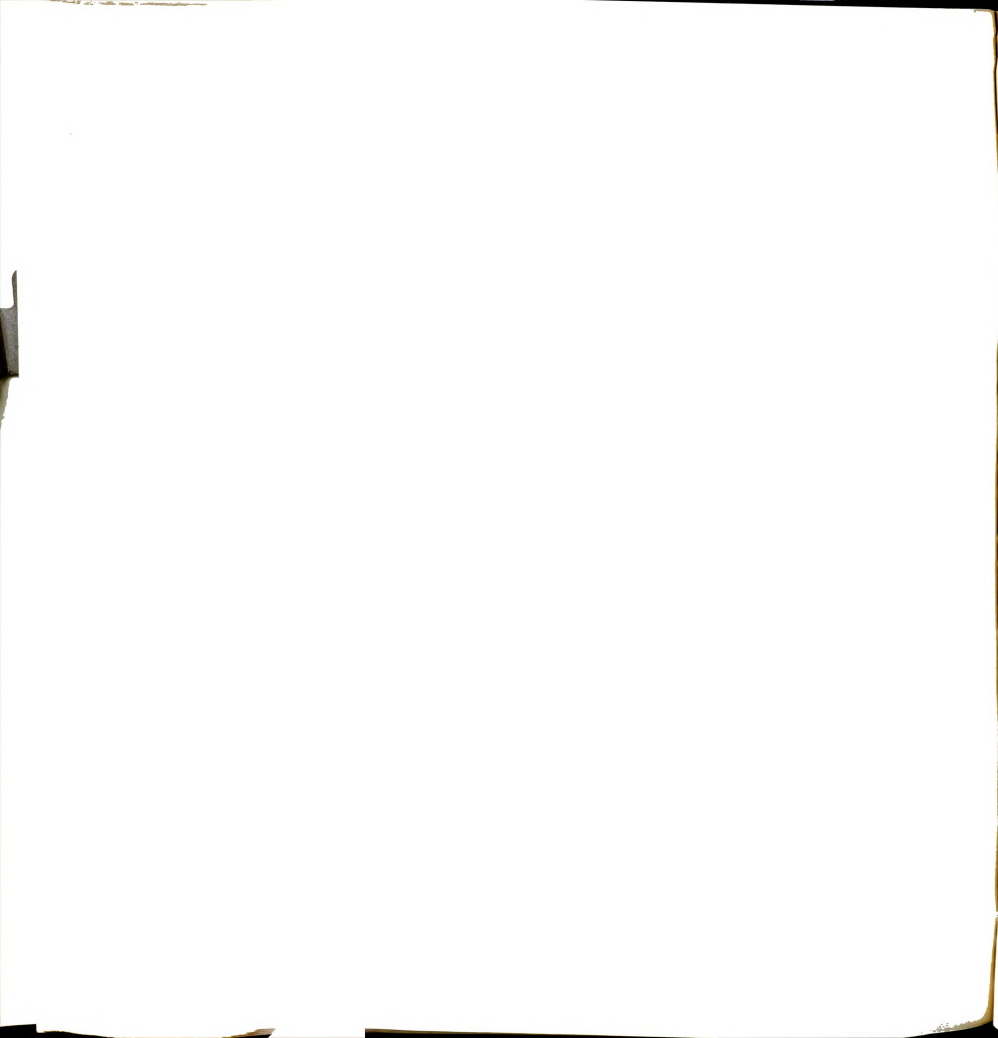
and a favorable market conduct for fertilizer distributing firms, the market forces of fertilizer supply and demand are restrained by the public policy, the magnitude of fertilizer imports and the domestic fertilizer market. Since the primary objective of a pricing policy is to maintain a remunerative price level for both the farmer and the distributor, it would be desirable that the government may maintain speculative inventories in various regions of West Pakistan. The retainment of government control at various strategic points would be necessary so that freer operation of the market forces of fertilizer supply and demand may not adversely affect the terms of trade between fertilizer and crop prices. It can serve to supplement the inadequate market price signal as well as to relieve the pent-up fertilizer demand by reinforcing fertilizer market supply through additional fertilizer imports which must be obtained on foreign exchange. Since the objective of maintaining a remunerative and stable price level is to guarantee a reasonable rate of return for the farmer and adequate profit margins for the private enterprise, it would, therefore, be recommended that emphasis should not be laid on reducing the profit margins, but on the adoption of cost-reducing methods which may generate greater economies of production and marketing. It is, however, a long run measure due to the fact that the adoption of new fertilizer technology and exploitation of the economies of size and scale requires a long period



of gestation. On the other hand, movements in the prices of fertilizer and commodities must be modified from time to time by the maintenance of speculative inventories, if a guaranteed and favorable rate of return to the farmer is to be ensured. The speculative role can, however, be assigned to the private enterprise wherever found necessary.

An Analysis of the Fertilizer Black Market

An undesirable phenomenon of the existing system of fertilizer pricing is the emergence of black market prices from time to time in various parts of West Pakistan. The causes may vary from a general excess of demand over supply to spatial structure of the fertilizer market. Variations in both supply and demand for fertilizer may lead to changes in prices beyond the publicly controlled level. On the supply side, uncertainty and irregularity in the volume and timing of fertilizer imports may lead to the left-ward shift of supply and cause a substantial rise in fertilizer prices. Bottlenecks in the temporal and spatial movement of fertilizer supply and demand are likely to create substantial variations in the price of fertilizer beyond the officially fixed price. Some of the reasons that can be adduced to the rise of black market prices are the existence of the spatial monopoly of a particular retail agent or due to the imperfection of the fertilizer market arising from transportation inefficiency.



Under the existing more or less oligopolistic structure of the fertilizer market, a private distributor aiming at profit maximization would sell that quantity of fertilizers where his marginal cost of marketing a unit of fertilizer equals the officially regulated price. Assuming that the regulated price at which a distributor can sell fertilizers is below the free market equilibrium price level and that the possibilities of the emergence of a black market are greater because of the existence of a fringe of unsatisfied demand at the officially fixed retail price OP . The process of emergence of the fertilizer black market is explained by the following diagram.

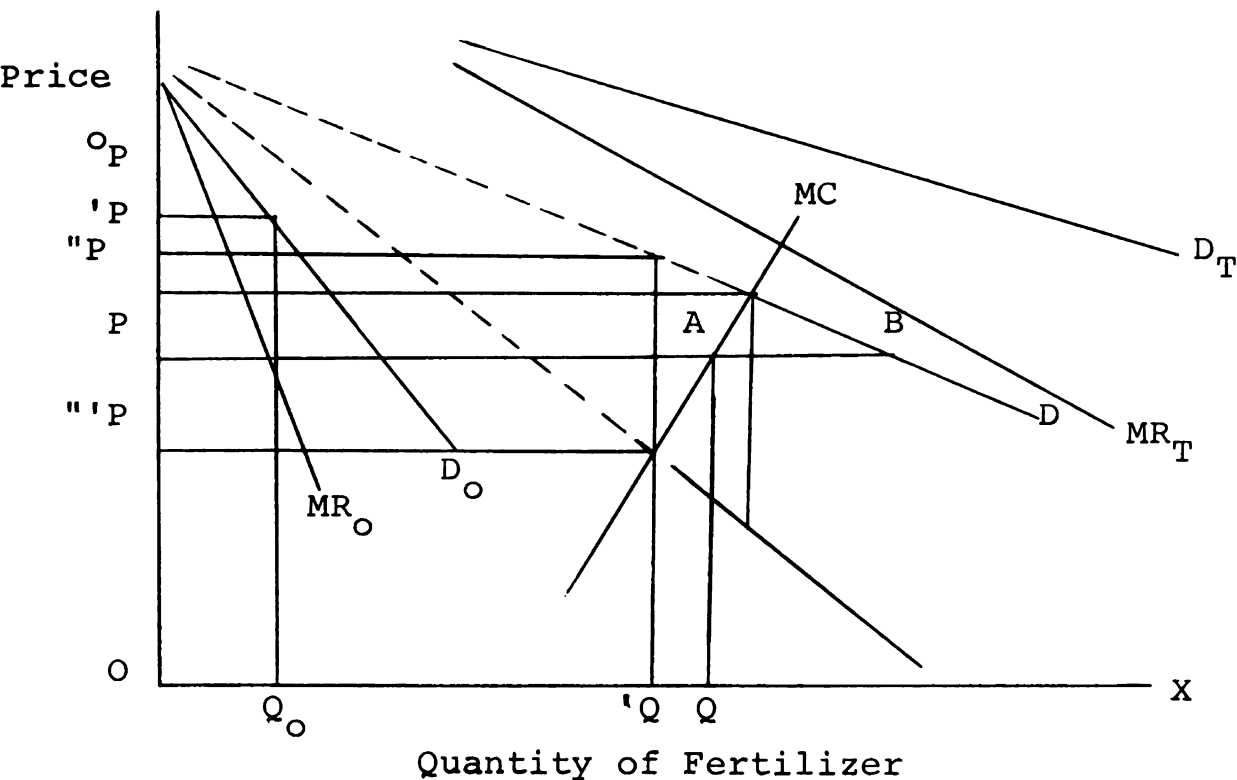
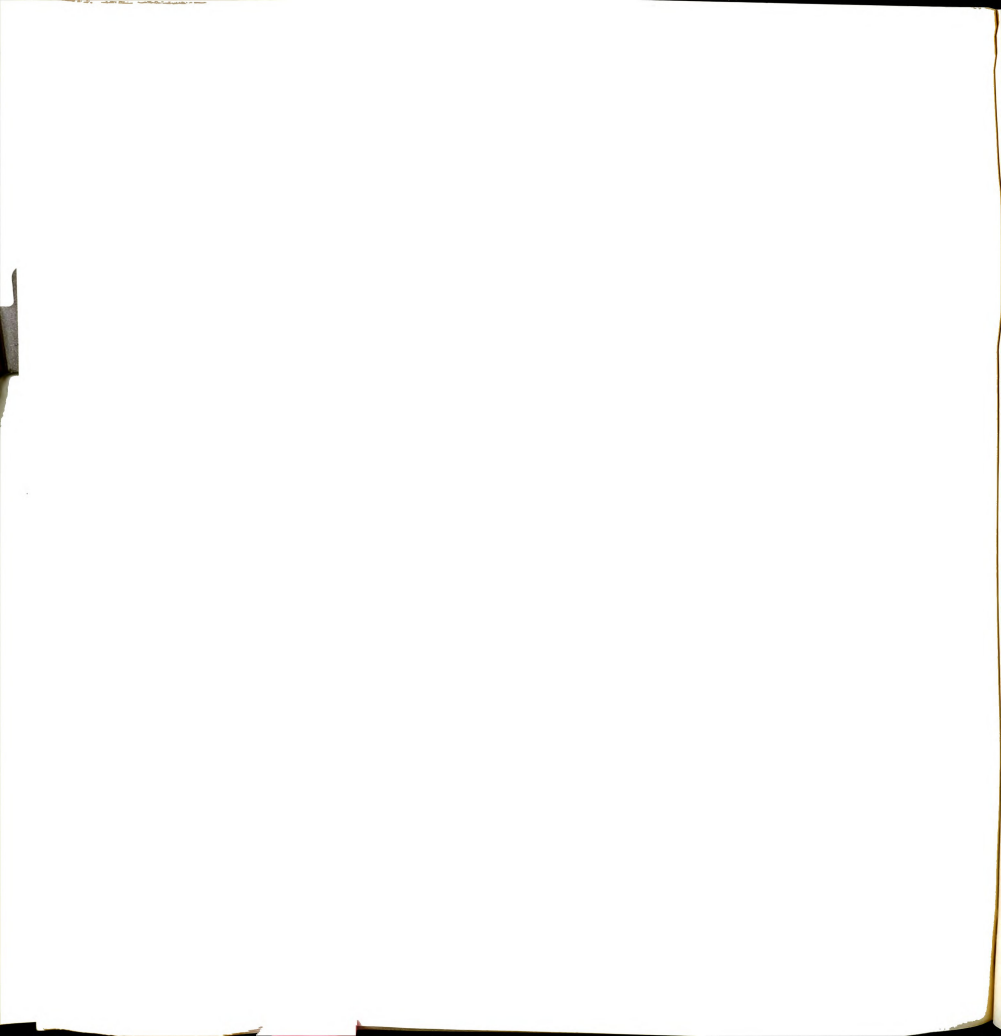
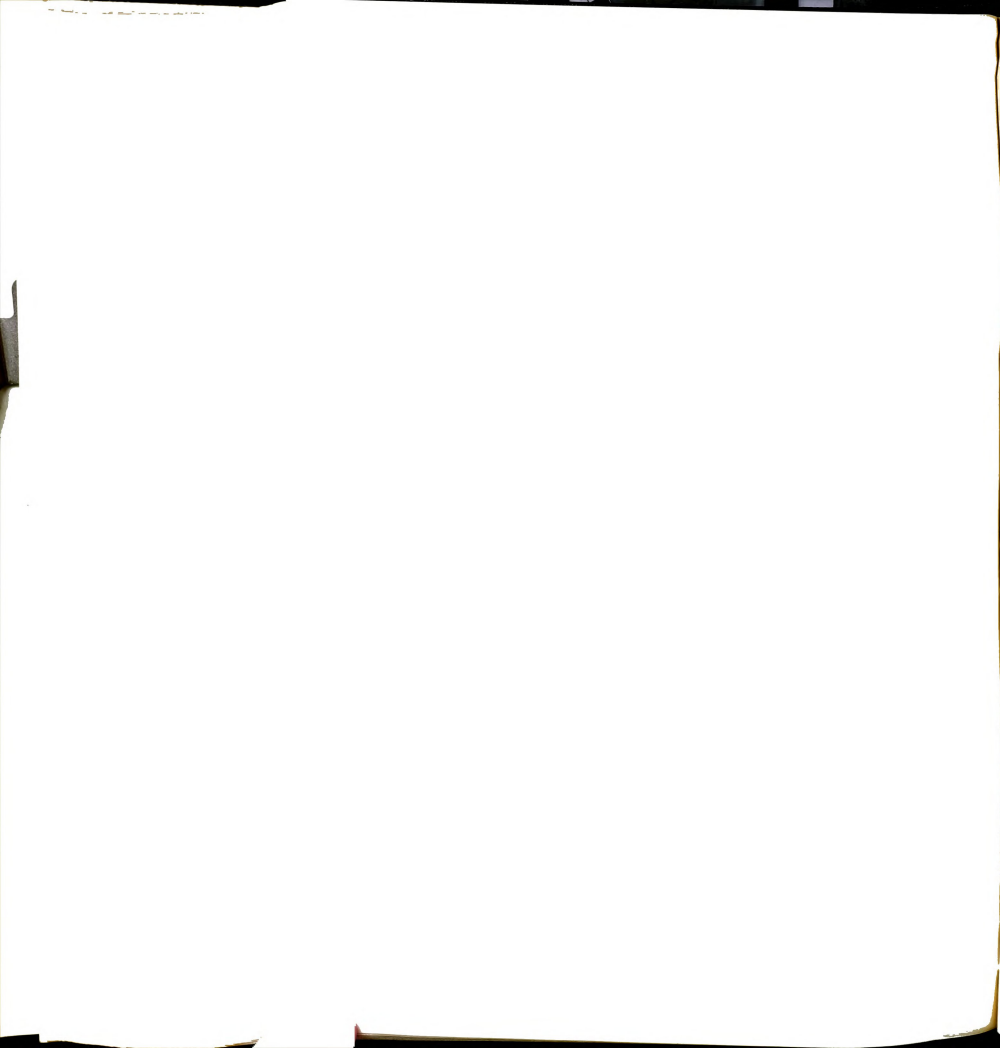


Figure 7.1. The Formation of Fertilizer Black Market.



In the above figure, a typical private fertilizer distributor is faced with the demand curve D and his marginal revenue curve MR where OP is the officially regulated fertilizer retail price which is apparently below the firm uncontrolled imperfectly competitive price. The private distributor would maximize his profits by selling OQ' units of fertilizer at OP' price which is above the competitive price level O^0P . Since the private distributor is supposed to sell fertilizer only at the officially regulated price OP , he will dispose of only OQ units of fertilizer, thereby creating an unsatisfied range of demand AB . It would lead to the emergence of a fertilizer black market which is assumed to be a certain proportion of the demand for fertilizer facing the individual distributor. The demand curve D_0 facing the fertilizer black market rises to the upward extension of D , whereas the corresponding marginal revenue curve MR_0 also rises to the left of MR . The fertilizer distributor, operating on the principles of price discrimination would maximize his profits by equalizing his marginal cost with the marginal revenues MR_0 and MR in both the black and white markets. Since the demand for fertilizer in the black market is much more inelastic, he will be able to sell fertilizer at O^0P price which is greater than the officially regulated price thereby making the controlled price system ineffective. The aggregate fertilizer demand and marginal revenue curves are, however, represented by

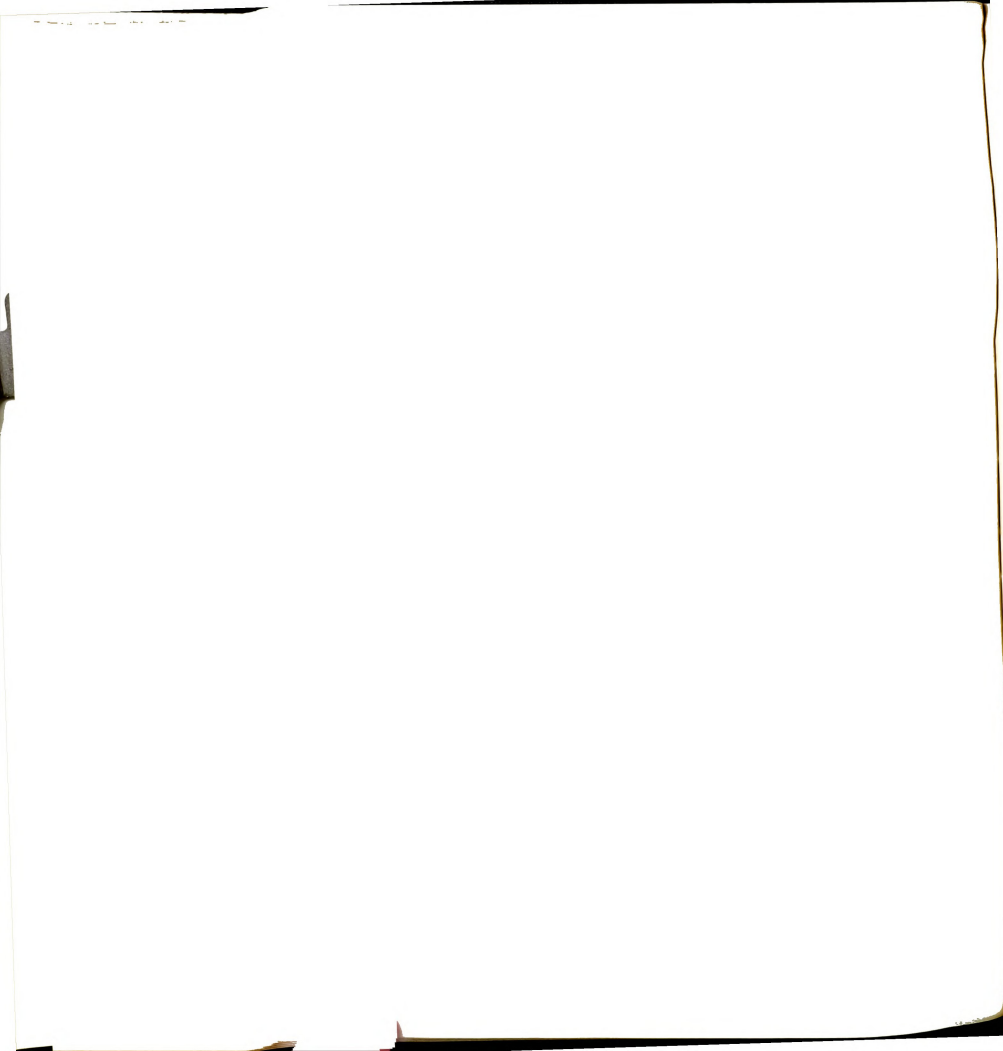


and MR_T . If we, however, assume an incremental premium uncertainty to the black market costs of private fertilizer distributor, as is normally the case when price movement is attempted, we ought to lower the black market demand curve D_0 .

Similar analysis can be extended to other fertilizer distributors in the market which will explain the behavior of fertilizer distributing industry in relation to the fertilizer black market. It would indicate the effectiveness of an officially fixed retail price, if it is below the uncontrolled imperfectly competitive level. It is also one of the causes of the ineffectiveness of the existing fertilizer pricing system in Pakistan because a general belief of the government officials is to ensure as low fertilizer prices to farmer as possible in order to stimulate fertilizer demand and increase farm returns as well as to provide the least possible profit margin for the fertilizer distributor. Another argument may be the general excess demand over supply at the fixed retail price which is maintained through a costly program of fertilizer subsidy. As adequate foreign exchange is rarely allocated for import of a required quantity of fertilizers.

Provision of Fertilizer Subsidy

Sale of fertilizers to farmers at subsidized prices as a tool of market development constitutes a cornerstone



West Pakistan's fertilizer policy. The rational economic argument is to provide fertilizers to farmers at a cheaper price in order to improve the relative and individual rate of return from the use of fertilizers. Since the farmers tend to overdiscount the returns from fertilizer use as compared to society, the subsidized price of fertilizers provides a compensating discount whereby farmers can attain a new and higher level of optimal fertilizer use. The primary objective of fertilizer subsidy is to induce the low income farmer into using fertilizer for raising farm productivity. A serious problem confronting the low income farmer, however, is the risk and uncertainty which is incident to the requisite cash expenditure on fertilizers and the attendant ambivalence on the part of the farmers in the commitment of their limited cash resources. Thus a single major crop failure arising from the ill-advised use of fertilizers is likely to liquidate a low-income farmer and greatly reduce his flexibility in attempting a similar experiment in meeting future emergencies.

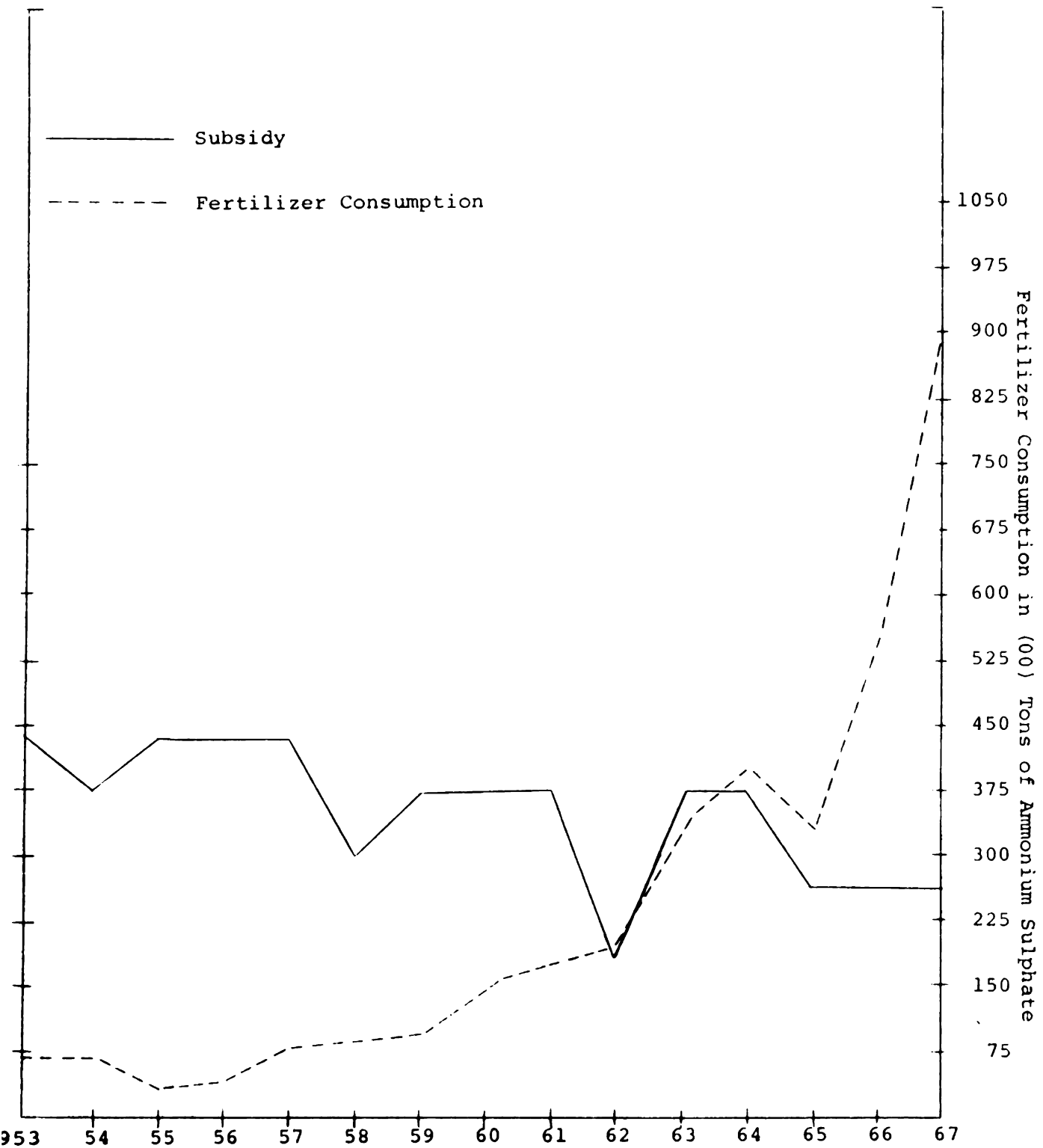
That fertilizer prices constitute an important variable in the production plans of farmers can be assessed from the comments of the Food and Agriculture Commission which after examining the question of fertilizer subsidy stated that:

. . . the rate of subsidy has been so variable from year to year and changed at such a short notice that much of the expected impact of subsidy was lost. . . . Fertilizer use is still in its initial phase, and to ensure widespread distribution, it is desirable that subsidy should continue and that the rate should remain unchanged over a number of years so that the farmer may not be left in doubt as to the investment he has to make.⁵³

As a result of the recommendations of the Food and Agriculture Commission, the government decided in 1961 to fix prices of fertilizer at about 50 percent of the cost to keep it constant throughout the plan period. A direct consequence of fertilizer subsidy is to generate a favorable fertilizer-crop price ratio vis-à-vis other inputs, thereby creating output and substitution effects. The aggregate impact of the fertilizer subsidy on fertilizer sales can be realized from the fact that the increase of the subsidy from 40 to 50 percent and its maintenance during the period 1959-61 resulted in more than a 100 percent increase in fertilizer use. That fertilizer subsidy is not the only variable accounting for the increase in demand for fertilizer is verified by the continuously rising trend in fertilizer consumption despite abrupt fluctuations in the level of fertilizer subsidy as illustrated in Figure 7.2.

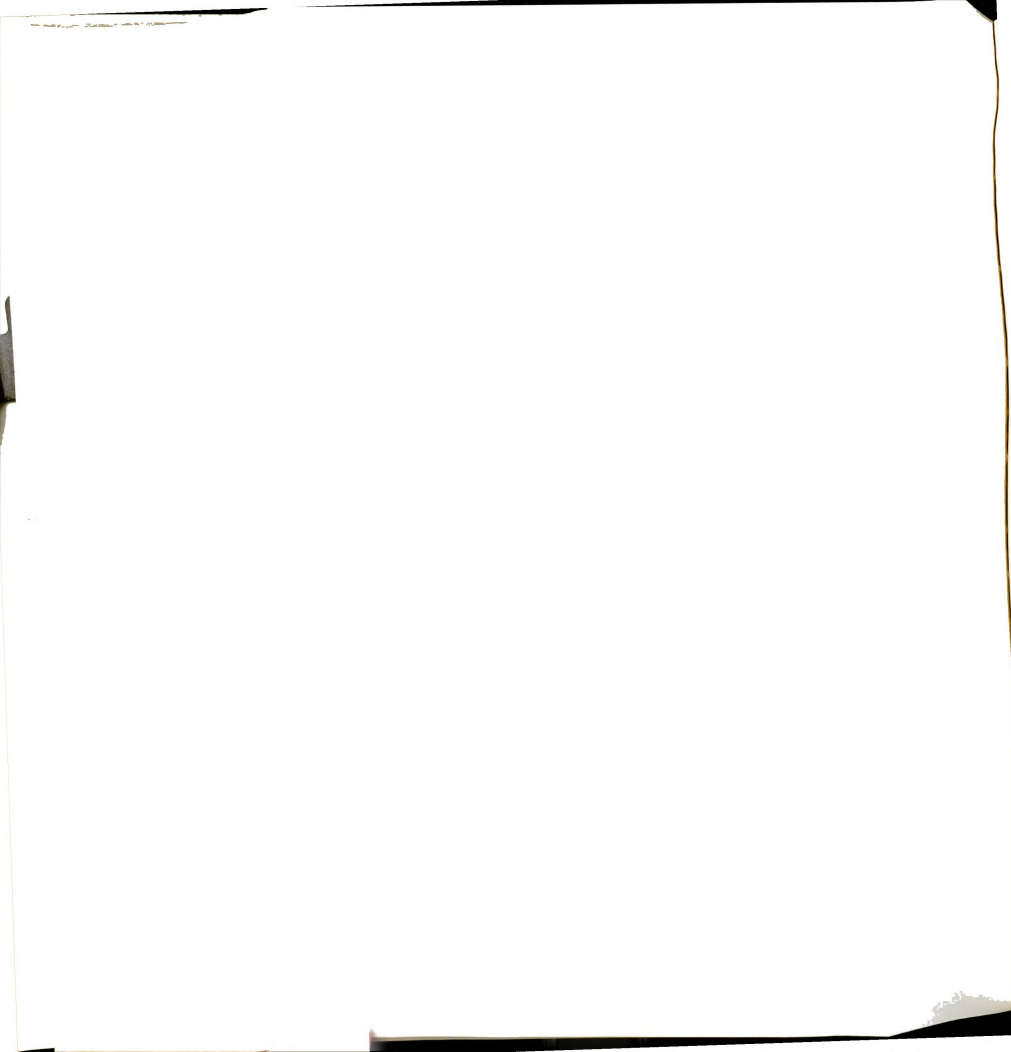
⁵³ Government of Pakistan, Report of the Food and Agriculture Commission, Manager of Publications, Karachi, p. 157.





Source: Aziz Ahmad, Agriculture in Pakistan (Karachi: USAID, 1967).

Figure 7.2. Fertilizer Subsidy and Consumption in West Pakistan.



Whereas price reduction is generally an accepted feature of sales promotion the extent to which the demand for fertilizer will increase in response to a given percentage reduction in price at various levels of the demand curve would depend upon the price elasticity of fertilizer demand at that particular level. Whereas fertilizer subsidy tends to improve the relative profitability of fertilizer and shifts the demand for fertilizer through output substitution effects, increased revenues from direct price support may or may not be spent for increased farm investment or the purchase of fertilizer. On the contrary, equivalent budget allocation for direct price support would simply tend to raise the average cost of food and raw materials for urban consumers. A major problem with the advancement of the fertilizer subsidy is, however, the rising volume of expenditure which is positively correlated with the rate of rise in fertilizer sales as illustrated in Table 7.2. The single major objective of the fertilizer subsidy is fertilizer demand expansion by ensuring better returns to farmers which could also be achieved by various means. The unilateral emphasis of public policy on subsidized prices as the sole means of attaining the indicated objective leads to misallocation of high opportunity cost resources insofar as trade-off seems to exist between the means. In order to maximize the effectiveness of a given budget allocation in achieving the desired objective, government can diffuse the use of

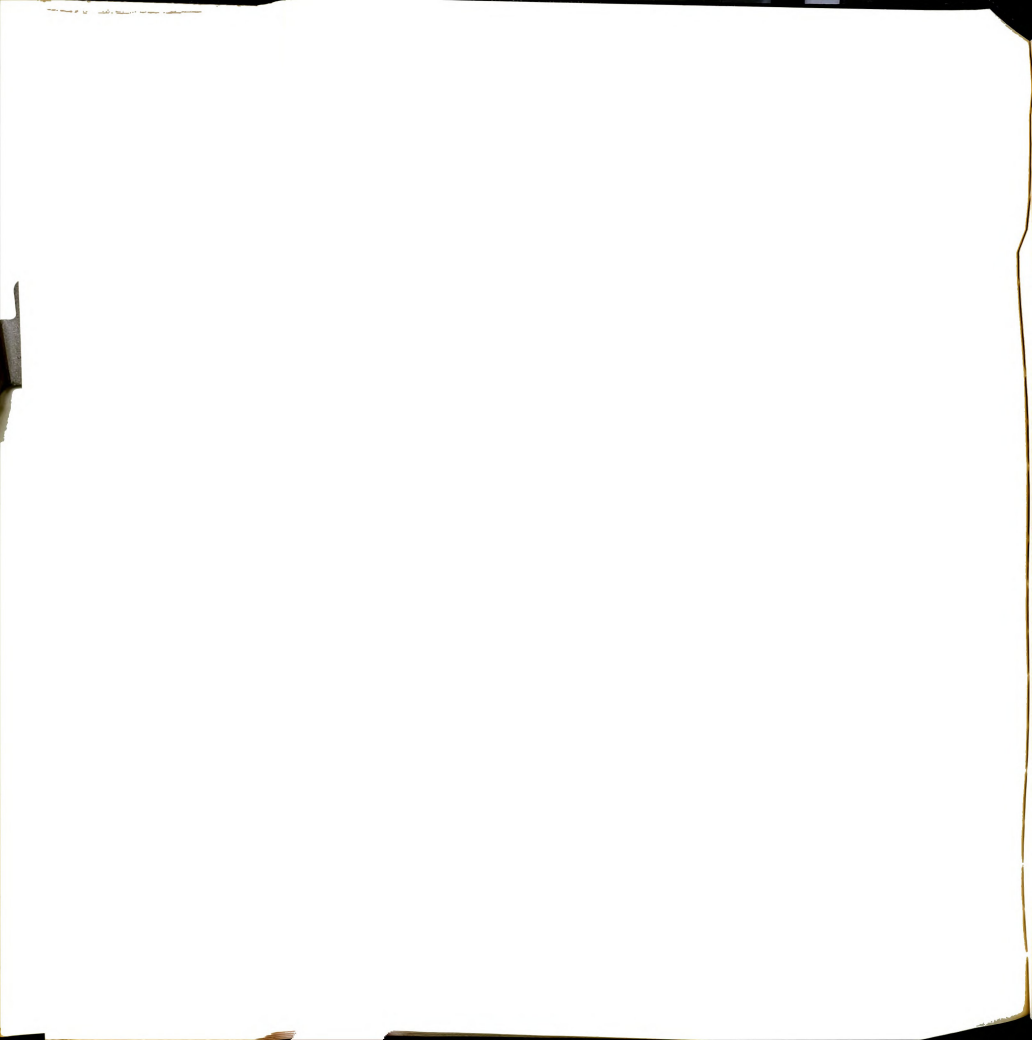
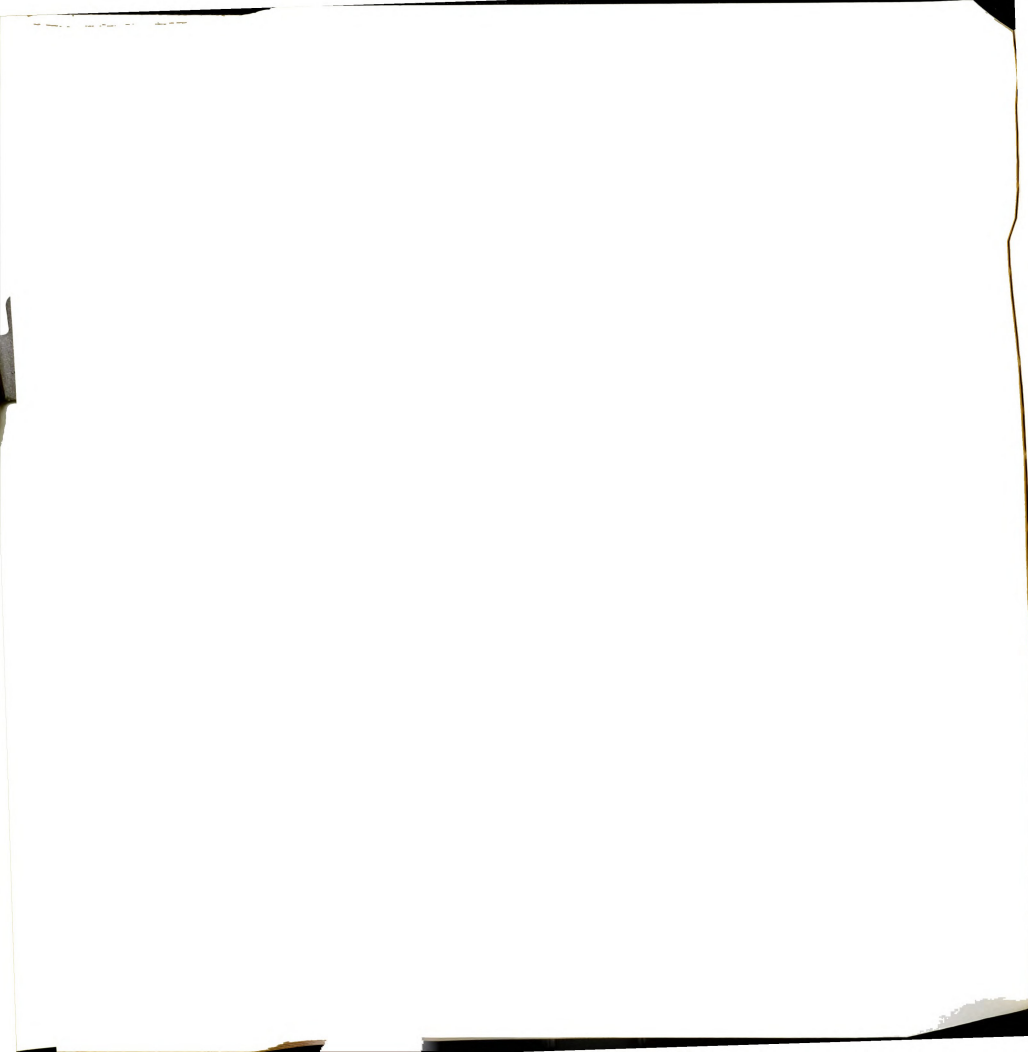


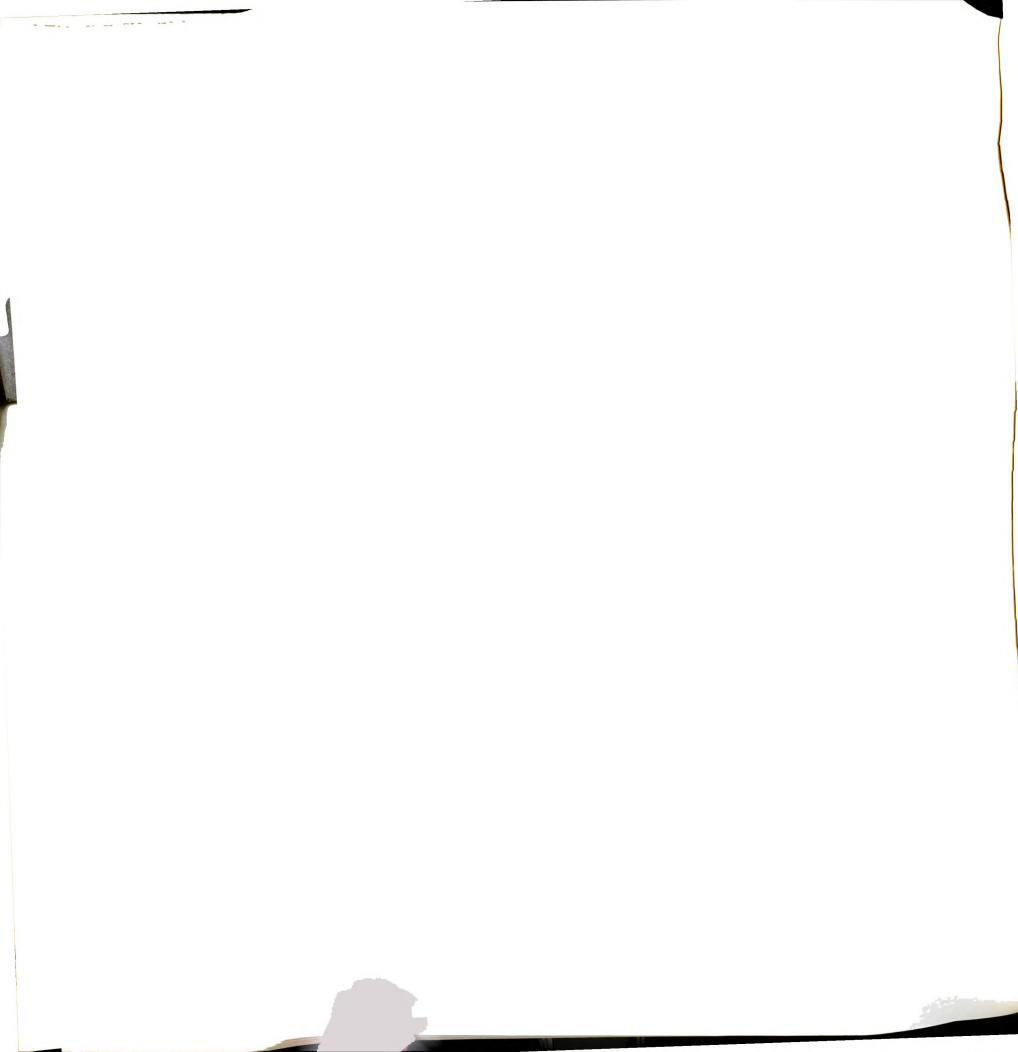
TABLE 7.2. Rate of Subsidy on Fertilizer Sales.

Year	Fertilizer Sales "000" tons	Percentage Subsidy (on Aggregate Sales)	Total Expenditure \$ Million
1960-61	149	50	N.A.
1961-62	179	50	N.A.
1962-63	197	25	1.554
1963-64	325	50	6.008
1964-65	405	35	4.244
1965-66	335	50	16.029
1966-67	549	35	22.122
1967-68	919	35	16.576
1968-69	N.A.	35	19.034

Source: Unpublished memos issued by the Planning and Development Department,
Government of West Pakistan, Lahore.



resources by shifting them from fertilizer subsidy into
 increased supply of soil testing facilities, extension of
 fertilizer credit, and provision of such auxiliary market-
 services as may reduce the real cost of local ferti-
 lizer delivery to the farmer. A diffused use of resources
 will tend to considerably relieve the government from
 the burden of an increasing volume of expenditure that
 goes into the maintenance of the subsidy program. Thus
 fertilizer subsidy may be justified insofar as it provides
 a considerable economic incentive to the farmer in over-
 coming a variety of social taboos and uncertainty of return
 to the use of fertilizers. It may be unjustified on the
 basis of its high budget cost and sources of finance. At
 present, the direct costs of fertilizer loan and sales
 administration are paid out of public funds and indirect costs
 are borne mainly on the taxpayers unless part of the tax pro-
 fits are recovered from increased farm output which may
 result from the use of fertilizers. On the other hand, a
 general decline in the price of farm products is likely
 to transmit some of the benefits of low prices to urban
 consumers. An interesting feature of the subsidy program
 is the differential rate of subsidy that is given on im-
 ported and indigenous fertilizers. The rational economic
 argument is to equalize the selling price of low-cost
 imported fertilizers with the high-cost indigenously
 manufactured fertilizers. Estimates for the year 1968-69

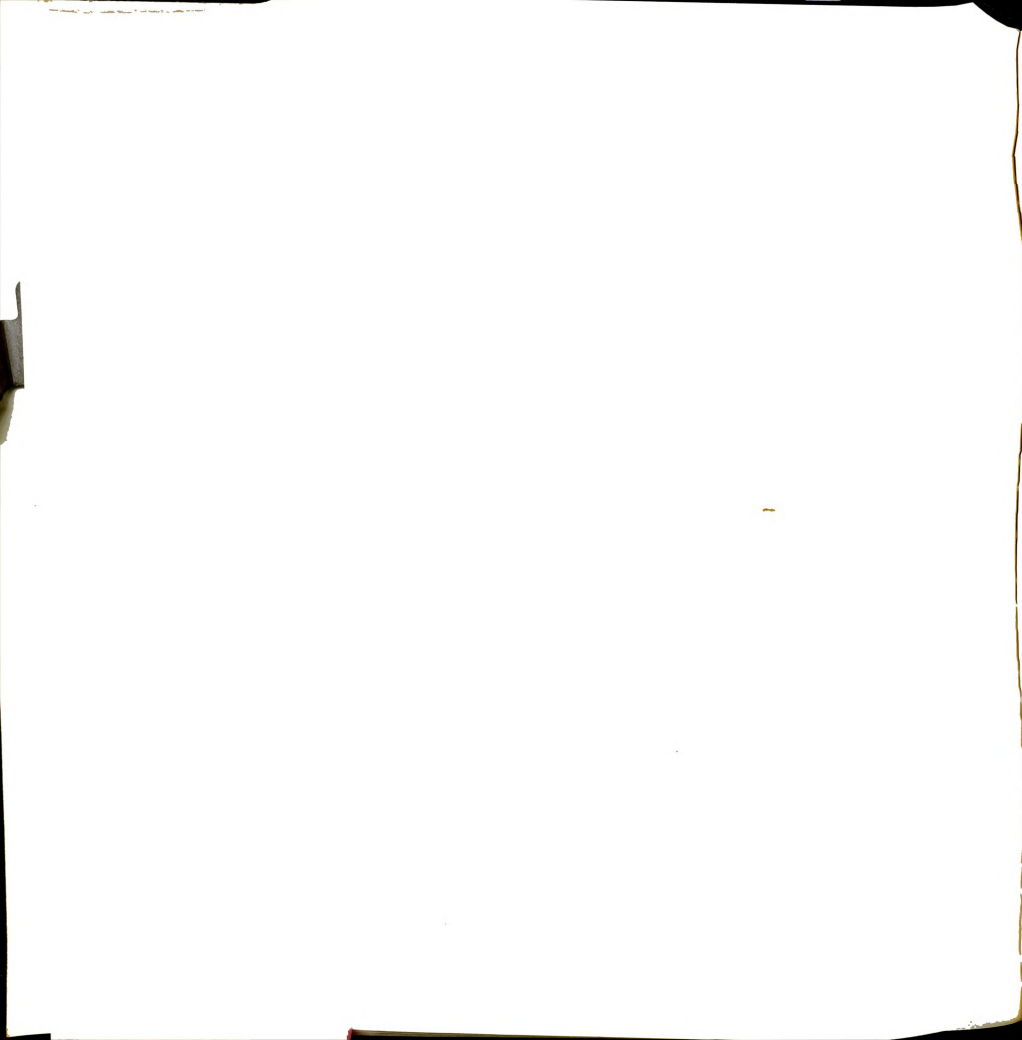


cate that the rate of subsidy was 25 percent on the f.o.b. Karachi price of imported fertilizers and 46.3 percent on the f.o.b. mill price of indigenous fertilizers.

An analysis of the social value system in Pakistan has indicated that the society places higher value on domestic production rather than dependence on the import of such staple foods as wheat and rice which constitute an essential part of the basic diet. In addition, one of the major objectives of the government is to attain self-sufficiency. Whereas a comparison of the benefit-cost ratios derived from the application of various doses of fertilizer by type indicates that the ratios for subsidized fertilizers in the production of wheat and rice are much higher than those for unsubsidized fertilizers as given in Table 7.3. Thus, a case can be made for the retention of fertilizer subsidy from an evaluation of the relative scale of benefit-cost ratios which indicates that the potential for fertilizer use is the highest in the production of wheat and rice. Whereas, from an individual farmer's point of view, the effect of fertilizer subsidy is to generate favorable returns from the use of fertilizers, the aggregate behavior of farmers may yield different results.

The Welfare Effect of Fertilizer Subsidy

The direct consequence of fertilizer subsidy is to raise the relative profitability of fertilizer to increase



Fertilizer Ratio	Ammonium Sulphate		Ammonium Nitrate		Urea		Super- phosphate		Triple Superphosphate	
	Sub.	Unsub.	Sub.	Unsub.	Sub.	Unsub.	Sub.	Unsub.	Sub.	Unsub.
Wheat Ratios										
5:1	2.12	1.06	2.34	1.17	2.19	1.09	2.24	1.12	2.76	1.38
8:1	3.39	1.69	3.75	1.87	3.51	1.75	3.58	1.79	4.42	2.21
10:1	4.24	2.12	4.68	2.34	4.39	2.19	4.47	2.23	5.52	2.76
15:1	6.36	3.18	7.02	3.51	6.58	3.29	6.71	3.35	8.28	4.14
20:1	8.48	4.24	9.37	4.68	8.78	4.39	8.95	4.47	11.05	5.52

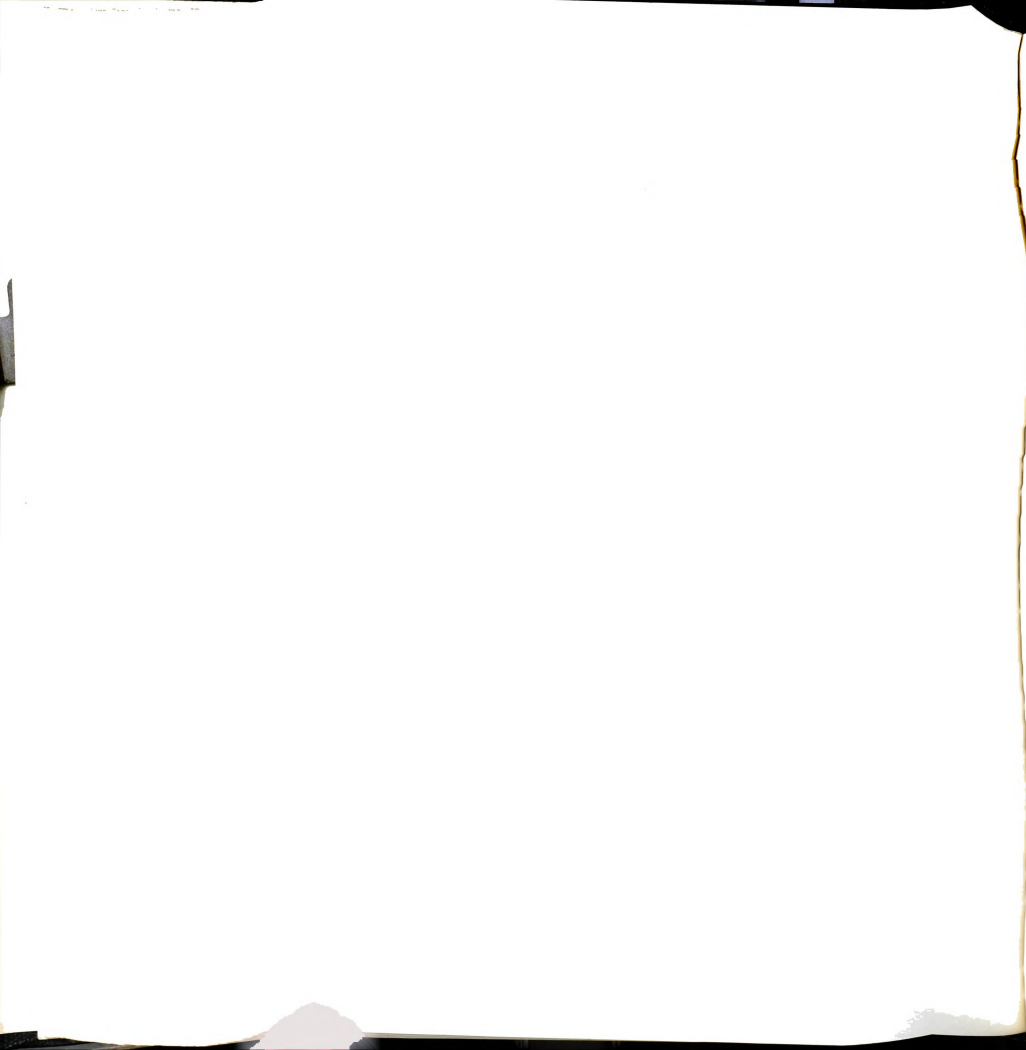
Note: An average wheat price is assumed to be Rs 17.5 per md.

Rice Ratios

5:1	4.26	2.18	4.81	2.40	4.52	2.26	4.60	2.30	5.68	2.89
8:1	6.97	3.49	7.70	3.85	7.23	3.61	7.36	3.68	9.09	4.54
10:1	8.72	4.36	9.62	4.81	9.03	4.51	9.20	4.60	11.36	5.68
15:1	13.08	6.54	14.43	7.22	13.55	6.77	13.80	6.90	17.04	8.52
20:1	17.44	8.72	19.24	9.62	18.07	9.03	18.40	9.20	22.72	11.36

Note: An average rice price is assumed to be Rs 36.00 per md.

Source: Computations are based on the unpublished memos issues by the Planning and Development Department, Government of West Pakistan, Lahore.



the real value of farmers' investible funds as well as to generate increased farm returns. The amount of increase in money returns to farm producers will, however, vary directly with the extent to which fertilizer prices have been subsidized and inversely with the general decrease in farm product prices because of an increase in aggregate farm output. The relative amounts of economic benefits and costs of fertilizer subsidy are indicated in the following diagram:

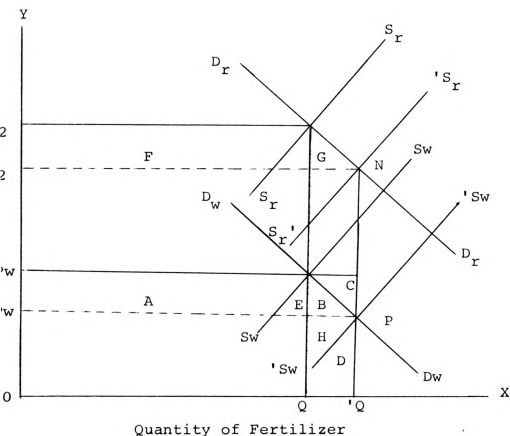
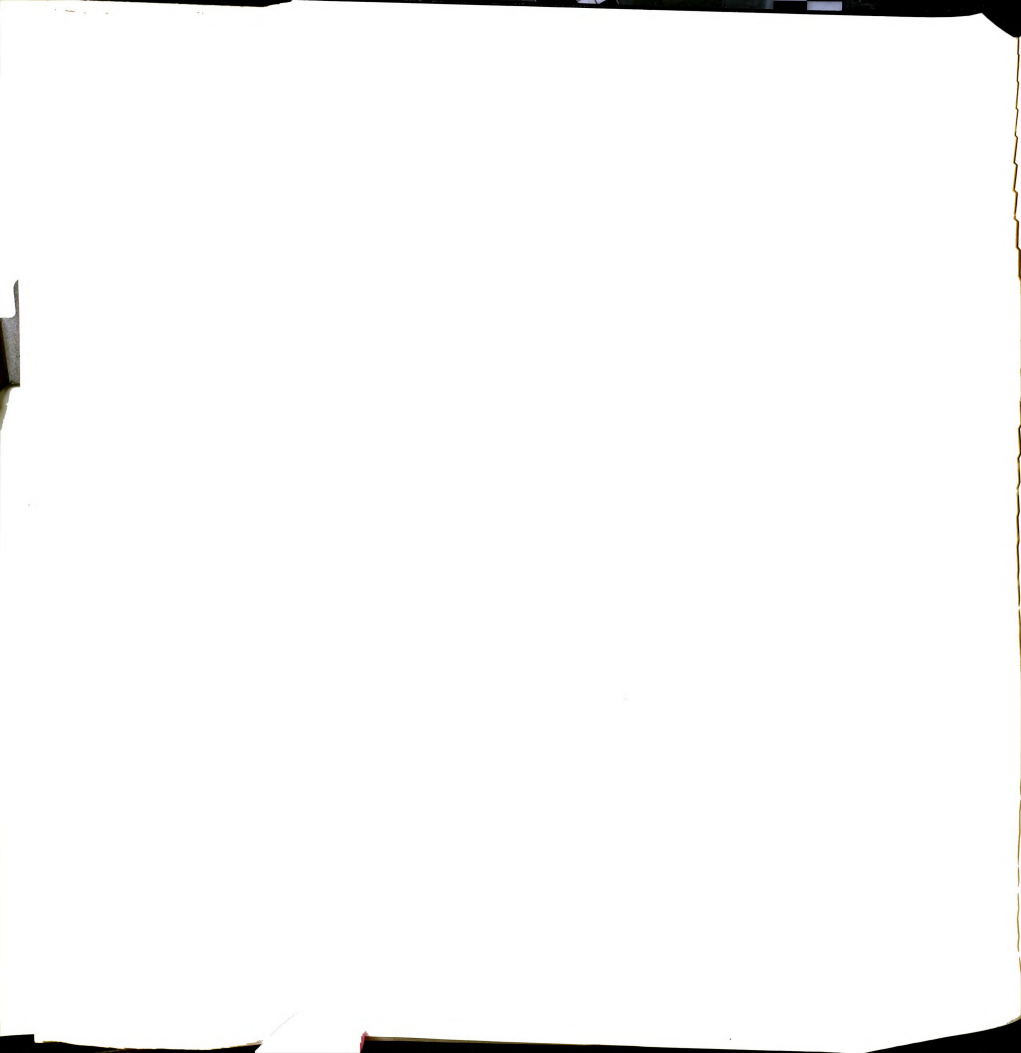


Figure 7.3. The Welfare Effects of Fertilizer Subsidy.

the total quantity of fertilizers that will be sold at the unsubsidized wholesale price P_w is indicated by OQ . At the subsidized wholesale price $O''P_w$ the quantity of fertilizers that could be sold in commercial channels would be QQ' which is determined by the intersection of wholesale supply curve S'_w and the demand curve D_w at point P . The quantity QQ' , however, represents the increase in demand for fertilizer. The expansion in fertilizer demand arising from fertilizer subsidy by the quantity QQ' would require an outlay of public funds equal in amount to that indicated by the sum of areas B , C , D , and H . Whereas the total outlay of public funds will be equivalent to the sum of areas A , B , C , D , E , and H . A similar decline in the retail price of fertilizers arising from the subsidized wholesale price would generate a new point of intersection for the retail fertilizer supply curve $'S_r$, and the demand curve D_r . The benefits of fertilizer subsidy to the farm buyers of fertilizer are measured by the sum of areas F and G . The analysis of measuring the benefits to farm buyers based on the Marshallian method of measuring consumer surplus assumes constant marginal utility of money to the individual purchaser. The changes in the price of fertilizer tend to influence the demand for fertilizer through their effect on the real income of farm-buyers, with results similar to those indicated by income-consumption curves and by increasing the

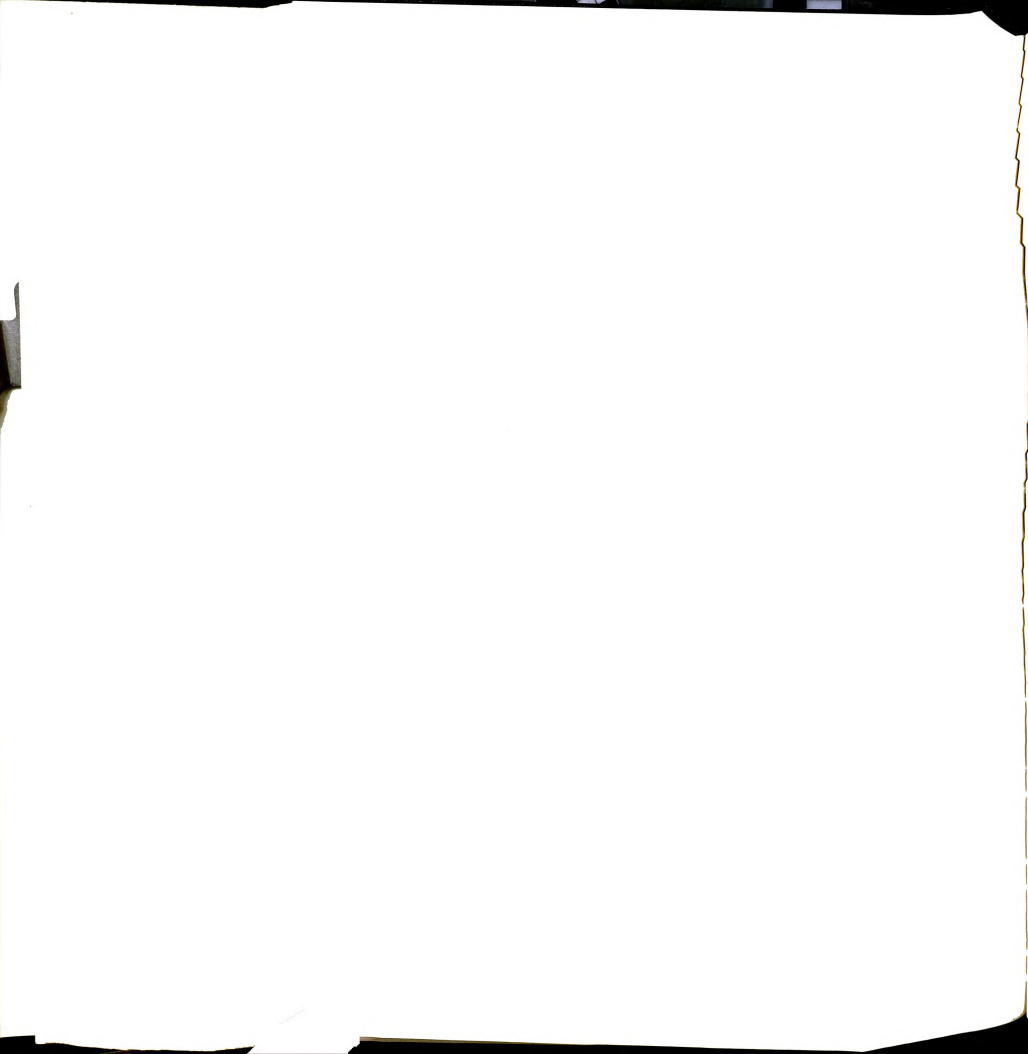


substitution of low-priced fertilizers for other farm inputs with results similar to those indicated by the price consumption curve.

In the short run, retention of the fertilizer subsidy may be justified on the grounds that social as well as private returns from a given subsidy program far outweigh the budget cost of financing it. In the long run, however, social returns begin to show a diminishing trend for an increasing budget cost of fertilizer subsidy that would be required to finance a rising volume of fertilizer sales. As a measure of public policy, it would be desirable that the rate of subsidy per unit of fertilizer be reduced gradually to the extent that the marginal social cost is equalized with marginal social returns.

Conclusions

An examination of the existing system of comprehensive price controls indicates that a major reason for the occasional emergence of black market prices is the inflated price and that a departure from it would be necessary in order to ensure greater pricing and distribution efficiency as well as a freer adjustment of the market forces of supply and demand.



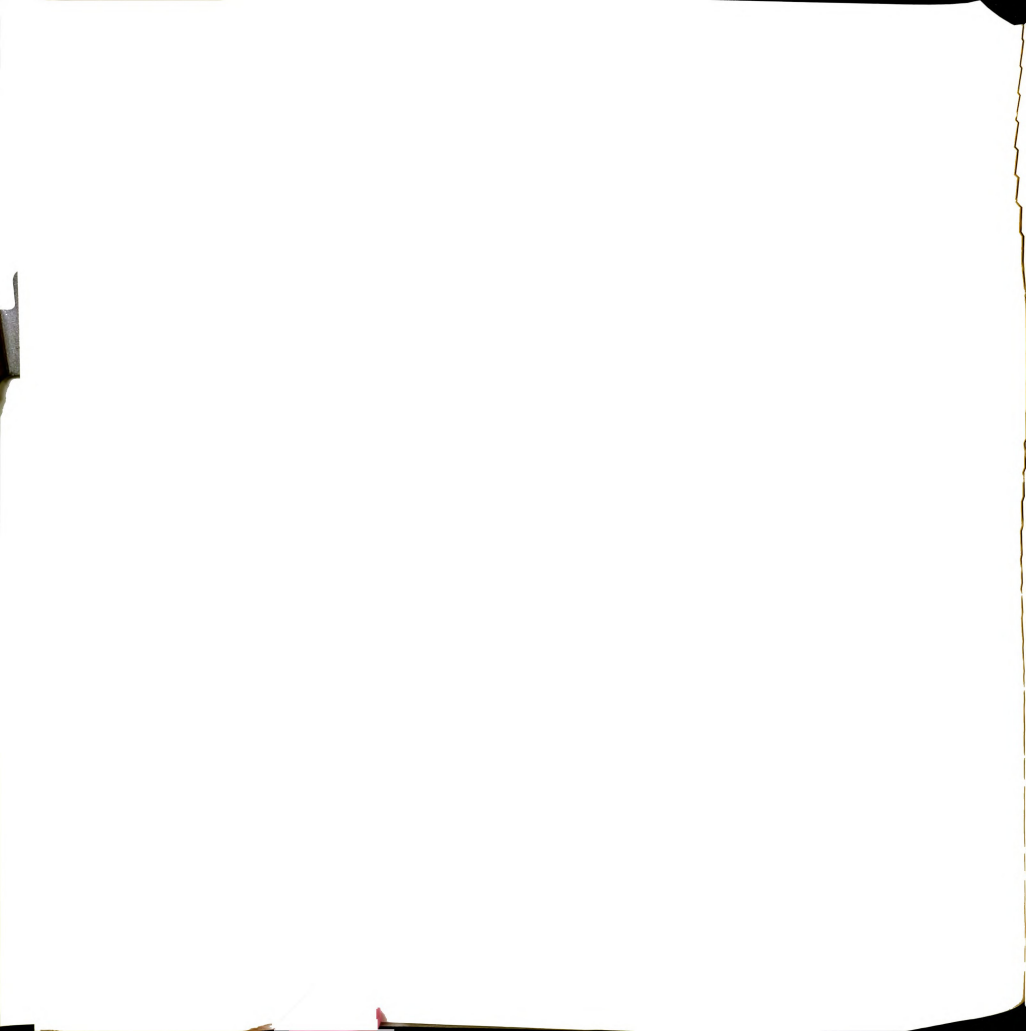
CHAPTER VIII

SUMMARY AND CONCLUSIONS

This final chapter includes a description of the ideas laid out in the thesis. The chapter is divided into the following three sections: (1) brief summary of the thesis, (2) conclusions and implications of the study, and (3) an evaluation of the hypotheses as set out in the beginning of the thesis.

Summary

Whereas each society has evolved systems of production and marketing in consonance with its social fabric and stage of economic development, the systems of input production in less developed countries are almost rudimentary or nonexistent. Though a wide range of opinions have been expressed concerning the behavior of input markets, there exists no set theoretical framework as a policy guideline in order to direct the operation of these markets. An attempt has been made to explain the inadequacy of traditional market structures to dynamically adjust to the distributive needs of new farm technology. In the input markets are heavily dependent for their



operation upon product markets, the process of interaction between the two markets assumes increasing importance. The difficulty in regard to the effective operation of product and factor markets primarily arises from a wide disparity between rural and urban areas within the underdeveloped countries. Industrial growth is inhibited by food shortages and high food prices while agricultural productivity lags because farmers perceive no stable and remunerative markets for their products. In short, the rural-agricultural and urban industrial sectors are not effectively coordinated.

The purpose of this thesis was to develop a relevant theoretical framework that explained the operation of farm input markets in the broader context of underdeveloped countries. An attempt has been made to discuss the marketing system in its development perspective and to evaluate the impact of price policy on the operation of farm input markets as a guideline for public policy. The basic objective is to lay out an initial framework to explain the operation of the fertilizer market in the context of West Pakistan. Since fertilizer is an industrial input which can be brought into commercial production through obtaining technical and financial assistance from the developed countries under the sponsorship of public or private enterprise, the major problem of West Pakistan is not how to produce it or consume it, but how to distribute it in response to a rapidly expanding demand within the

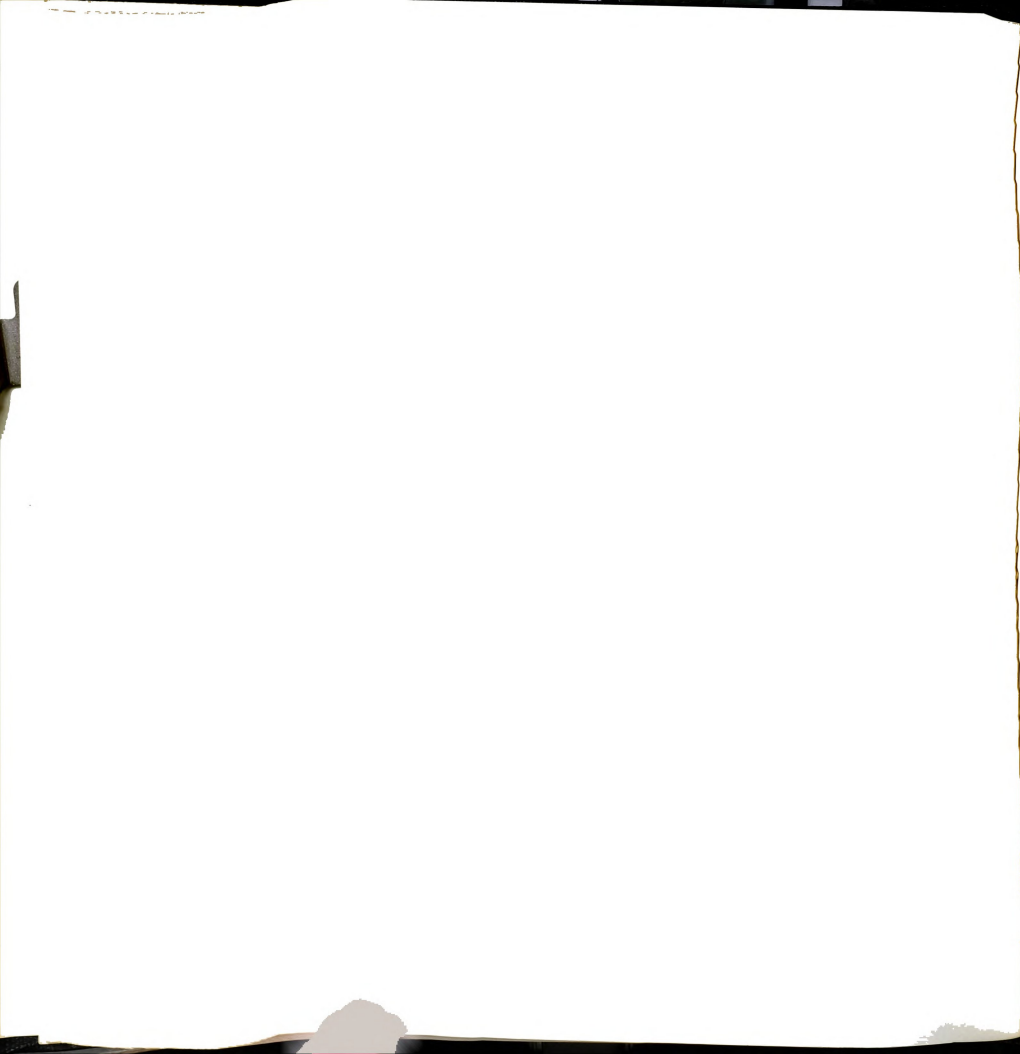
context of an agriculturally less developed country. As fertilizer is supposed to constitute a vital link in the chain of fertilizer supply and demand, the operation of each of the market forces was separately explained.

On the supply side, the existing and proposed fertilizer production capacity was examined with a view to evaluating the impact of fertilizer supply on the distribution system. Since the supply of fertilizer tends to be continuous over time the effects of the existence of economies of size and scale and idle capacity on the cost of production were evaluated. It was proposed that a secular decline in the cost of production of fertilizer was necessary to ensure lower cost of crop production to the farmers. On the demand side, complementary factors that tend to affect the demand for fertilizer were examined to analyze the extent of stimulation and contribution of each factor towards demand expansion. Since the demand for fertilizer is seasonal, the causes underlying the spatial and temporal variation of fertilizer consumption were examined.

The aspect relating to fertilizer distribution has been examined from the organizational point of view. The criterion developed to analyze the fertilizer market channel indicated that the existing system of channel organization was inadequate and outdated. Thus, in order to make further suggestions for the improvement of



fertilizer distribution system, the history of fertilizer distribution was examined from the point of view of fertilizer channel ownership and control. As an alternative to the existing system of distribution, a privately organized vertically integrated system of fertilizer distribution was suggested. In order to avoid the problems arising from the development of deficits and surpluses of fertilizer, a system of channel coordination for the interfirm flow of fertilizer was proposed. Since the local delivery of fertilizer at the farm level and its spatial movement were of urgent concern to the distribution system, a regional marketing system was proposed to streamline the process of physical distribution. For reasons of convenience, West Pakistan was divided into five major fertilizer consuming regions in order to intensify fertilizer distribution activity at the farm level. The various local points in the system of regional marketing were supposed to be constituted by the location of distribution centers at the district, distribution sub-centers at tehsil, and fertilizer retail outlets at the farm level. A chain of warehouses was proposed to assist the process of fertilizer movement over time and space through the replenishment of fertilizer inventories at various levels of the distribution system. Since an articulate network of transportation constitutes a vital link in the system of fertilizer allotment and quotas and a controlled fertilizer pricing system that a freer adjustment of the



market forces of supply and demand would be necessary to improve pricing as well as distribution efficiency.

Conclusions and Implications of the Study

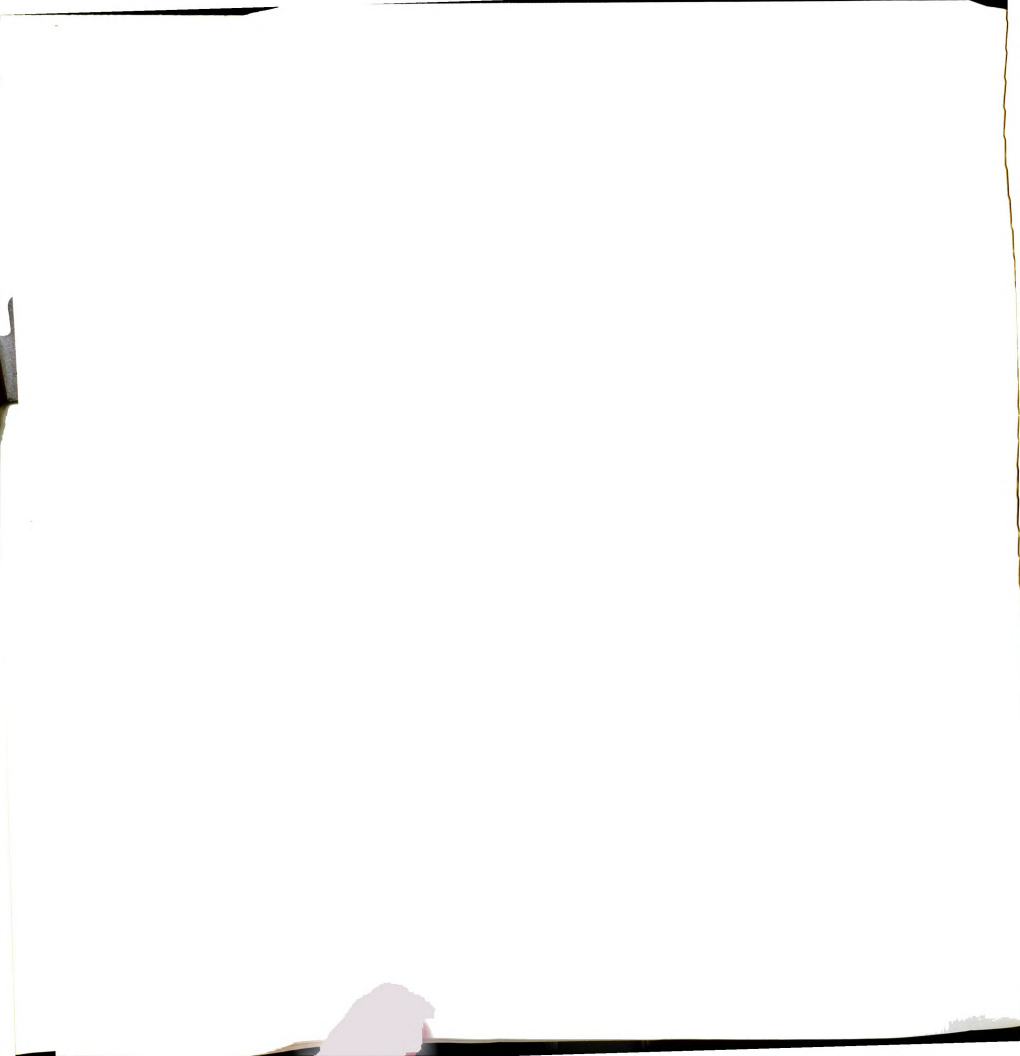
The overall purpose of this study was to provide information for the policy formulators in the government of West Pakistan that would assist them in making such policy decisions as would lead to an improvement in the performance of fertilizer distribution system. Some of the policy measures that can be based on the foregoing analysis are as follows:

1. The western region of Pakistan, like other developing countries, is passing through a transitional stage and has a less developed farm input market as compared to product market which has evolved gradually over a long period of time. Because of the low per capita income, low farm productivity and less developed urban and farm sectors, there exists no such Rostovian National market⁵⁴ which may bring about coordination between factor and product markets. Because of the inadequacy of traditional market structures to adjust to the demands of new technical inputs, it is recommended that the public sector should complement the private sector through the provision of such infra-structural facilities and technical

⁵⁴W. W. Rostow, View From the Seventh Floor (New York: Harper and Row, 1964).

assistance to the marketing sector as may require larger investments and the social returns for which are supposedly higher than the private returns.

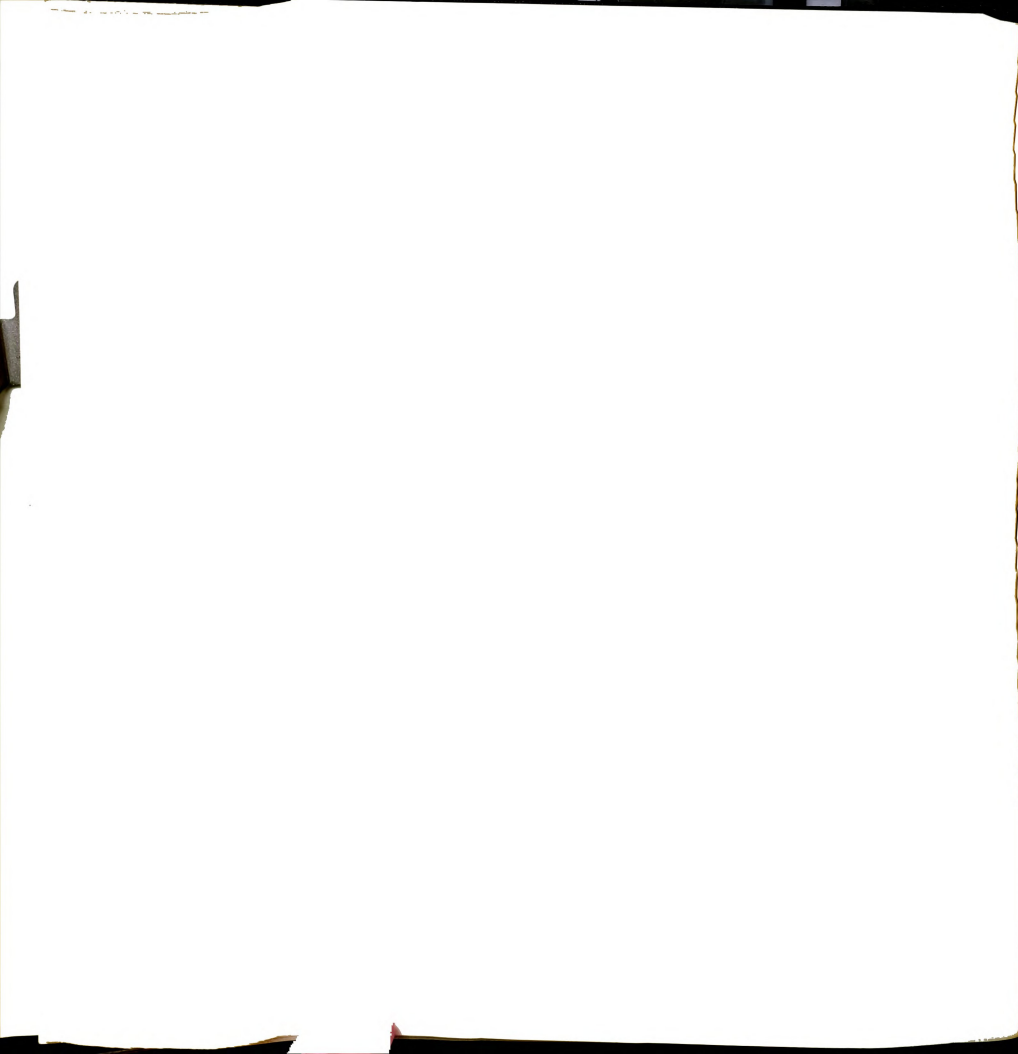
2. An evaluation of the performance of domestic fertilizer industry indicated that most of the fertilizer plants were operating much below the rated capacity. Almost all of them were technologically obsolete and the size of plants was small and the rate of capacity utilization so low that the economies of size and scale could hardly be utilized. Some of the plants had higher rated production capacity than the anticipated fertilizer demand of the marketing radius they were supposed to serve. The major agricultural regions and fertilizer market centers of Peshawar, Lahore, and Rawalpindi divisions were found to be almost out of the location polygon. It may, therefore, be recommended that the government should ensure the availability of spare parts and determine f.o.b. mill price of fertilizers with a due consideration towards the production and cost schedules of each firm in order to stimulate greater capacity utilization of the existing fertilizer plants. It must incorporate as recent fertilizer technology as possible in the erection of new fertilizer plants to minimize per unit cost of production, to attain greater production efficiency, and in the general interests of the farming community.



3. An overall analysis of the market forces of fertilizer supply and demand indicated that the most volatile component in the aggregate supply was constituted by fertilizer imports and that variations in this component could lead to fluctuations in the level of fertilizer availability at the farm level as well as the frustration of production plans of farmers. The social and private costs of lower harvests can, however, be avoided only through a well-timed scheduling of fertilizer imports and adequate allocation of foreign exchange. The procurement procedures for the import of fertilizers must be initiated at least six months before the next crop year sets in; and the arrival of fertilizer shipments must be so regulated that an unnecessary accumulation of inventories does not occur either at the Karachi seaport or at various railheads.

4. An examination of the demand aspect for fertilizers indicated that the level and intensity of fertilizer use tends to vary with the magnitude of the availability of complementary inputs. A greater availability of these inputs can, however, lead to a major expansion in the demand for fertilizer. Assuming a given supply of fertilizer-responsive crop varieties, a relatively elastic supply of irrigation water would lead to considerable shift in the demand for fertilizer.

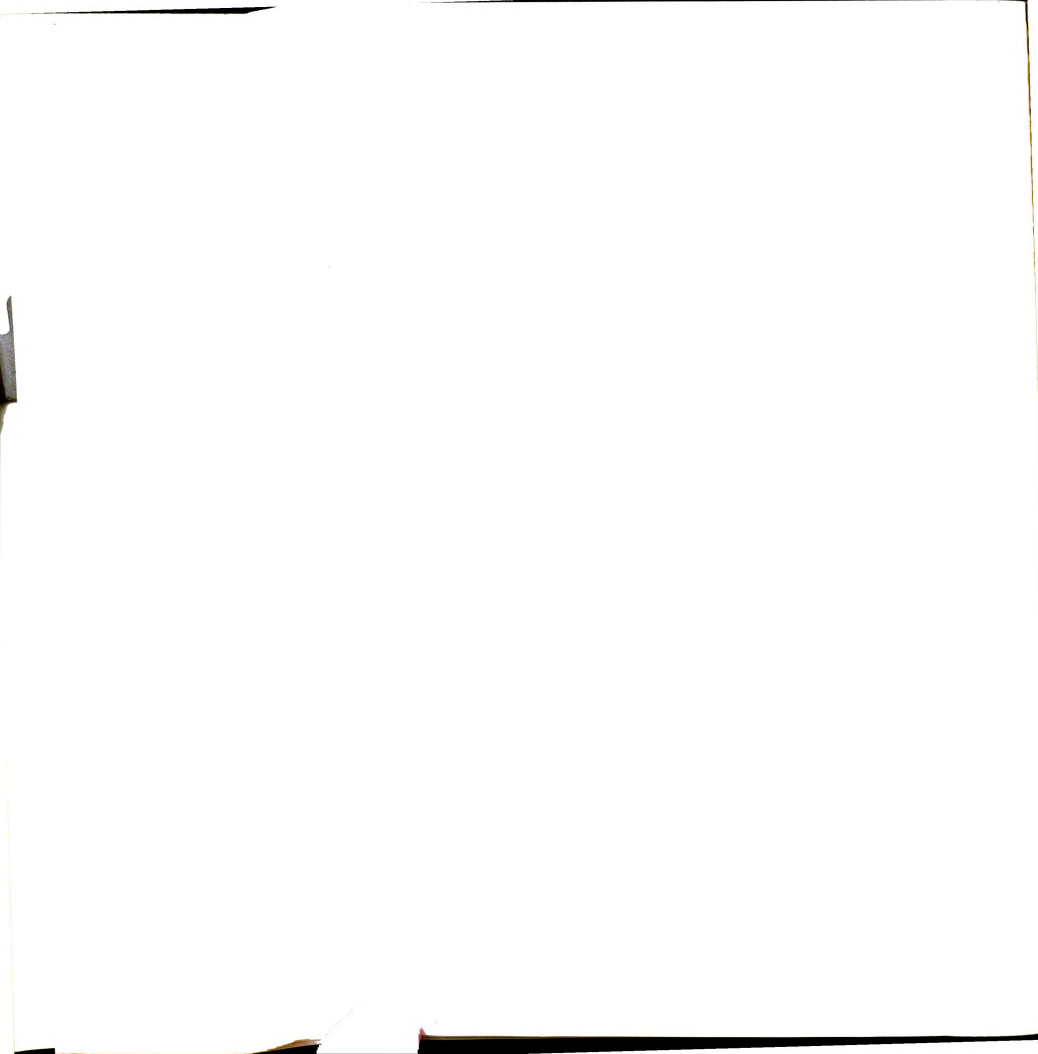
though the supply of these inputs in a "package form"



ould be desirable, the major emphasis must be laid on stepping up the supply of irrigation water.

5. An evaluation of the fertilizer market channel organization and its operation from the point of view of ownership and control showed that the transfer of distributive activity from public to private agencies must take place, if a distribution system free from administrative controls is to be generated and the elements of profit-motivation and competitive strategy among them are to be incorporated. A further analysis of the market channel on the basis of the effectiveness of the exchange mechanisms operating at various levels of the channel indicated that it did not satisfy the norm of effective competition. The application performance criteria of: (1) efficiency, (2) progressiveness, and (3) coordination brought out the fact that it did not satisfy the above norms. It was, therefore, recommended that the government should try to substitute a privately organized and vertically integrated system of distribution which may more nearly approximate the aforesaid norms.

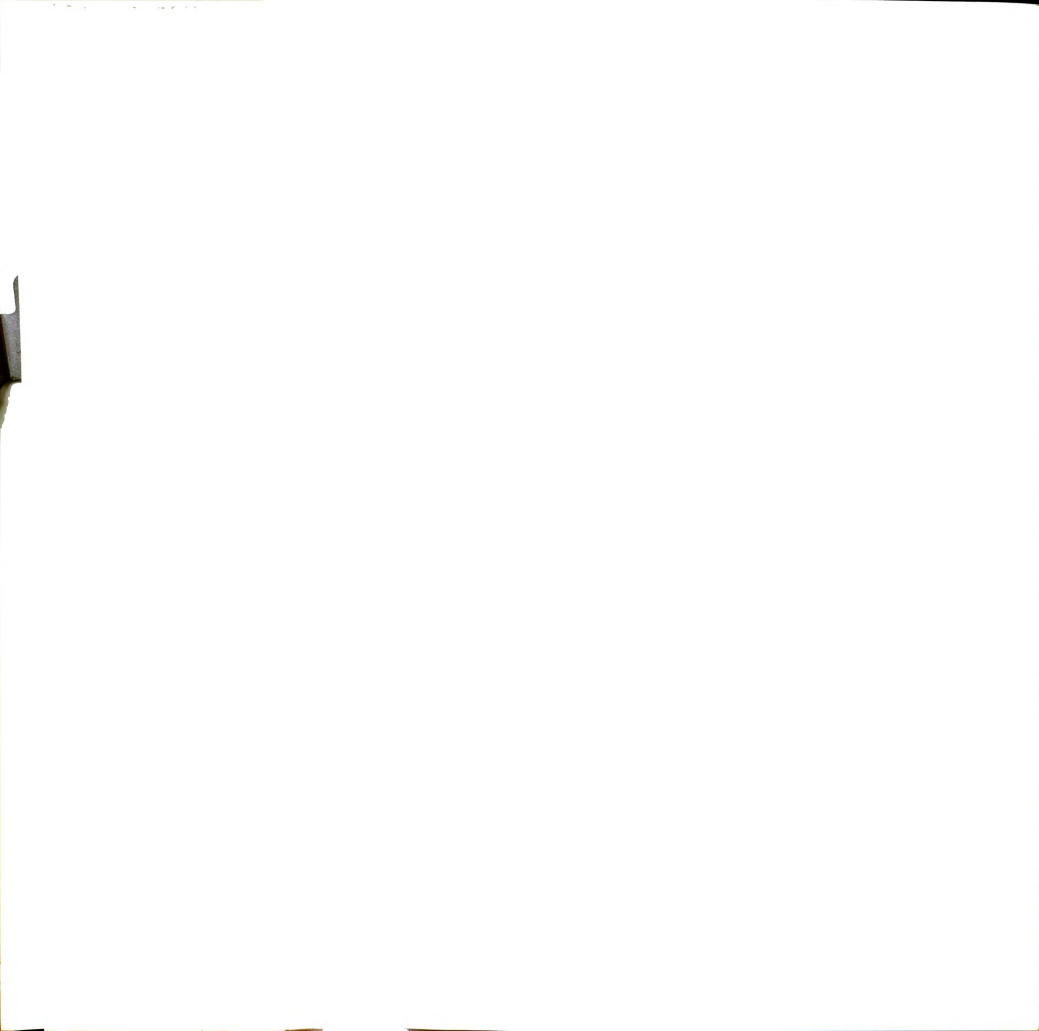
6. A more vital link in the system of fertilizer distribution is, however, constituted by the effectiveness of local fertilizer delivery. In order to intensify the fertilizer distribution activity, West Pakistan was divided into five major fertilizer consuming regions and a strategy of distribution was devised whereby a



chain of distribution centers and sub-centers at district and tehsil levels, respectively, was to be organized. The installation of a chain of warehouses and coordination as well as expansion of the rail and road fertilizer transportation were considered to be a vital component of the system. This scheme of distribution puts its major reliance upon import-substitution and development of regional fertilizer production capacity so as to intensify the intra-regional distribution activity. Thus a government measure to improve the physical movement of fertilizer would be well advised, if it proceeds along the indicated lines.

7. A major area of concern to the system of fertilizer distribution is the government's allocative activity itself and the determination of market exchange rules which may be too restrictive so as to limit the profit-maximizing activity of private distributing firms. The possibilities of vertical conflict were also discussed in the previous chapters which may arise from the dichotomy between planning and policy execution. Thus, it can be suggested that the government should shift the process of fertilizer procurement by distributing agencies to the operations of market mechanism.

8. The existing system of comprehensive fertilizer price controls lacks incentive-orientation for the fertilizer distributor and is impractical insofar as it is



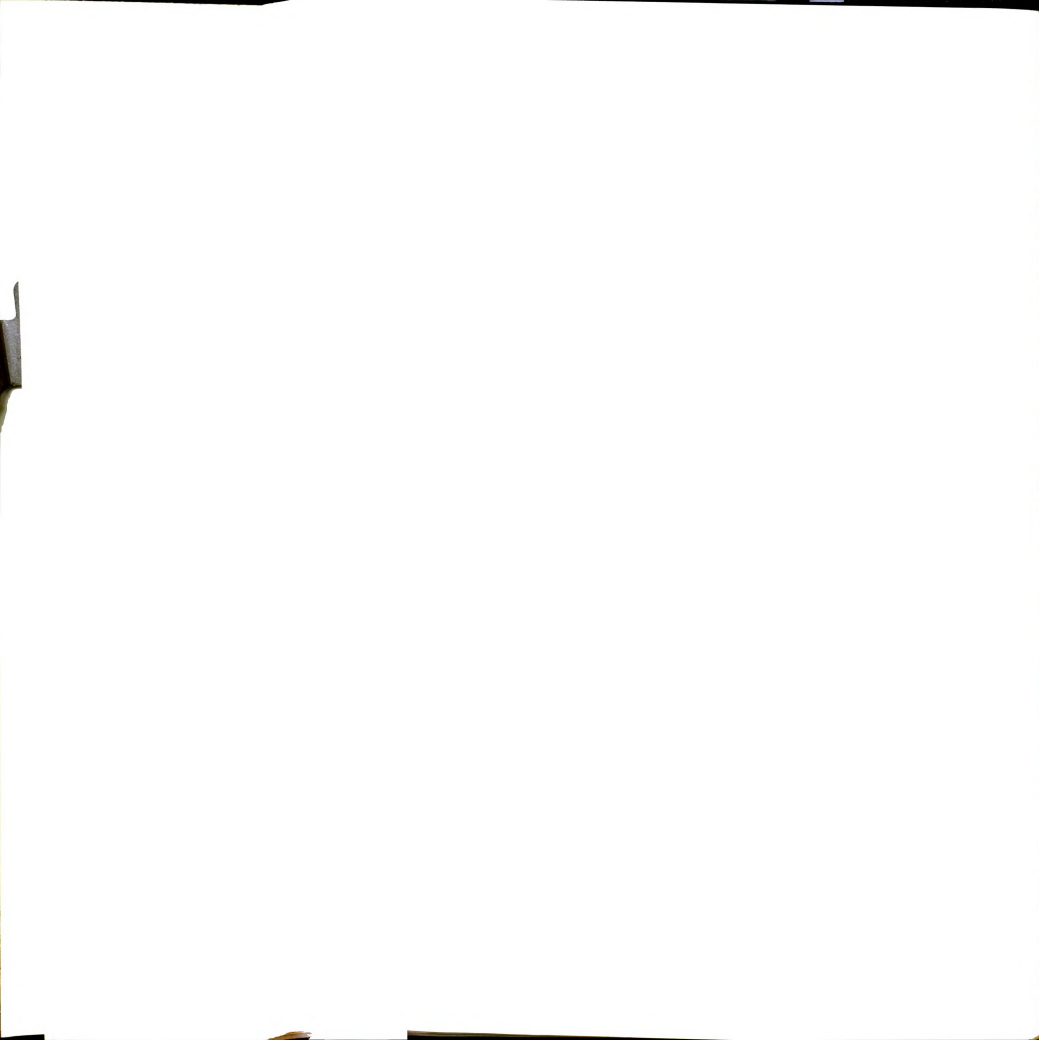
difficult to supervise. The price formations arising from the equilibrating adjustments of fertilizer supply and demand tend to oscillate around the regulated price over space and time. Since the fixed retail prices tend to suppress these forces, it leads to the emergence of fertilizer black markets. It may, therefore, be suggested that the government should implement fertilizer pricing system—as discussed in Chapter VII—which is free from administrative controls. Due to the small size of fertilizer industry, the possibilities of a rise in fertilizer prices which may reduce the relative profitability of fertilizer and thus farmers' returns are greater. It can, therefore, be recommended that the government should maintain speculative inventories in order to maintain fertilizer prices within a desirable range in the larger interests of both the fertilizer producer and farmer.

Evaluation of Hypotheses

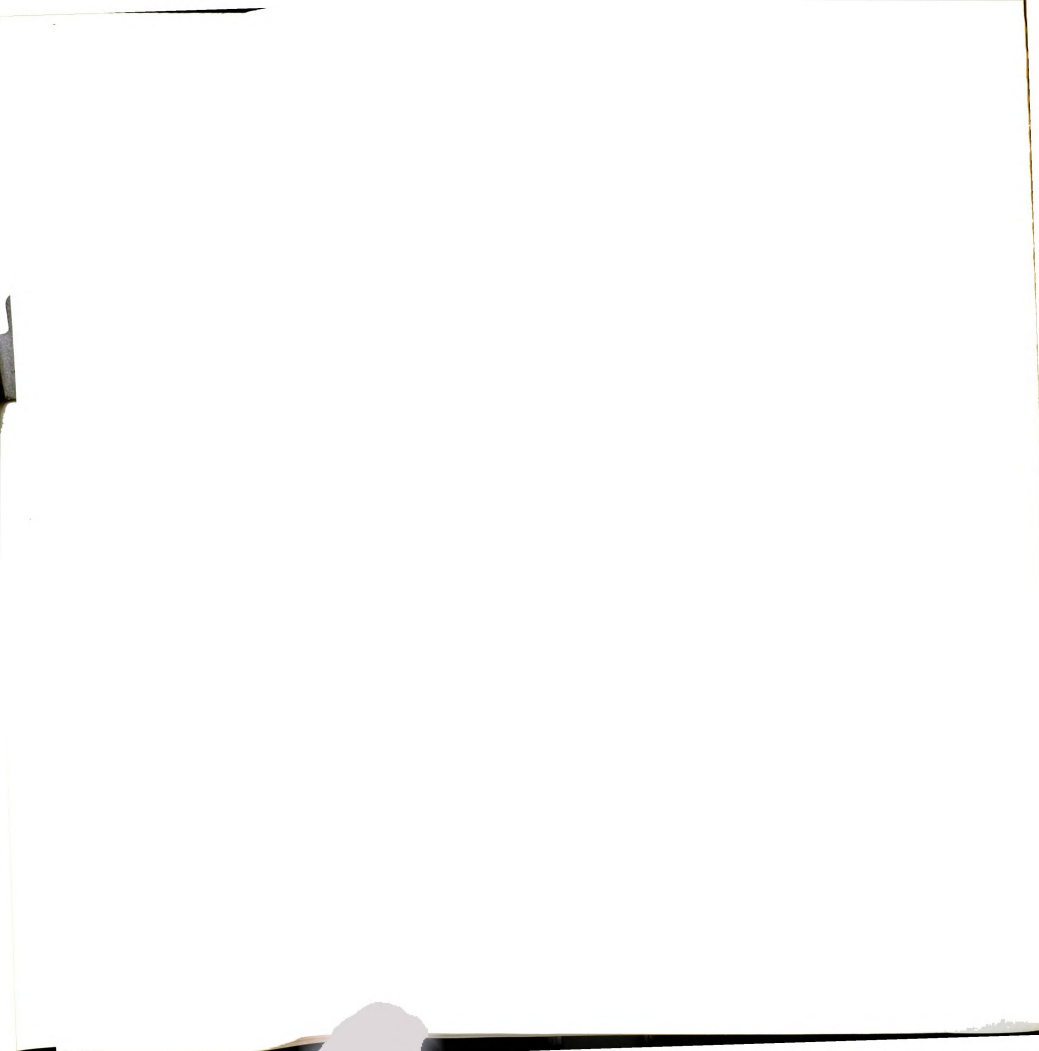
In relation to the bottlenecks in the system of fertilizer distribution and imperfection of fertilizer market in rural areas, the first hypothesis was stated as follows:

Hypothesis 1

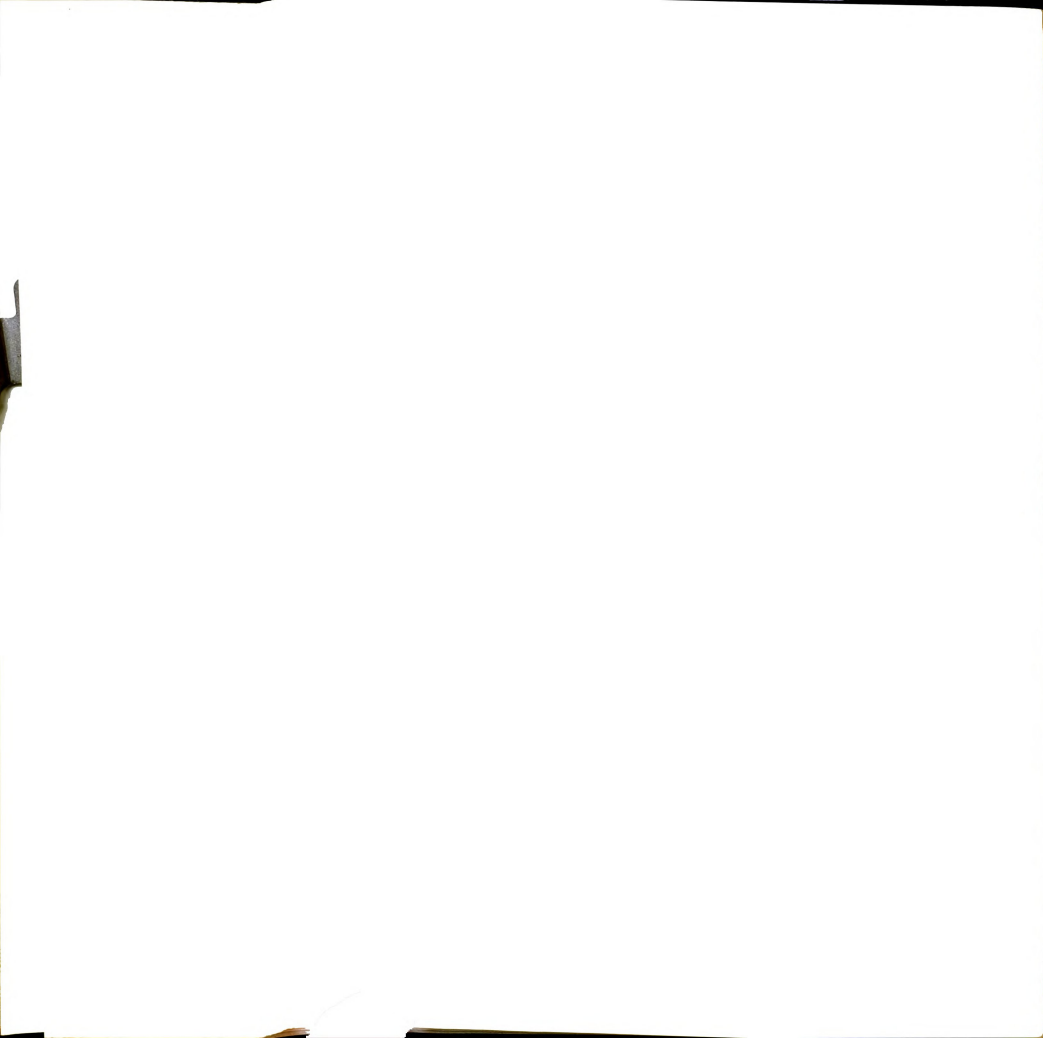
Apart from favorable fertilizer response and economic environment fertilizer use depends upon the physical availability of this farm input at the local level.



The available evidence indicates that in spite of favorable economic environment maintained through fertilizer subsidy which has been advanced by the government in varying percentages since the inception of fertilizer use in West Pakistan, and a foodgrain price support policy which has remained in effect from time to time, fertilizer use has been below the desirable levels. It may be added that the availability of fertilizer-responsive varieties has, though, considerably increased the potential absorptive capacity of farmers, yet the actual level of fertilizer consumption has remained very low, because of nonavailability of fertilizers at the farm level. Since the methods of fertilizer demand assessment do not take into account the various economic as well as non-economic variables that influence the demand for fertilizer at the farm level, most frequently the plan targeted supply of fertilizers lags behind demand. In addition, due to bottlenecks in the system of fertilizer transportation and paucity of an arterial low-capacity route system and village access roads, fertilizer hardly reaches the mandi level where farmers purchase fertilizers. Since the commercial farmers with a considerable marketable surplus are the only ones to have business contacts with a mandi town, the fertilizer retail outlets located at the mandi level remain inaccessible to those subsistence and commercial farmers who tend to rely for their purchases upon



itinerant market intermediary whose single function is that he purchases farm produce from the village and resells it in the mandal towns. Thus, fertilizer is available only to a small number of farmers at the publicly prescribed rate whereas the rest of the farmers either simply do not get fertilizer or the real cost of its delivery to the farmers at their doorstep tends to be so high that it virtually wipes away any returns accruing to them from fertilizer subsidy or the foodgrain price support system. Since the supply during a particular year has technological as well as economic limitations, an excess of demand forces up the fertilizer price, thereby reversing the ratio of favorable returns from the use of a unit of fertilizer. Thus, in order to make it physically available and to reduce its real cost to the farmer at the local level, imperfections in the fertilizer market must be eliminated by providing an enlarged system of fertilizer transportation. The transfer of a new function to the market intermediaries operating at the farm level for the sale of fertilizers would facilitate the process of local distribution. A streamlining of the process of fertilizer distribution would be necessary in order to ensure a favorable economic environment for fertilizer use.

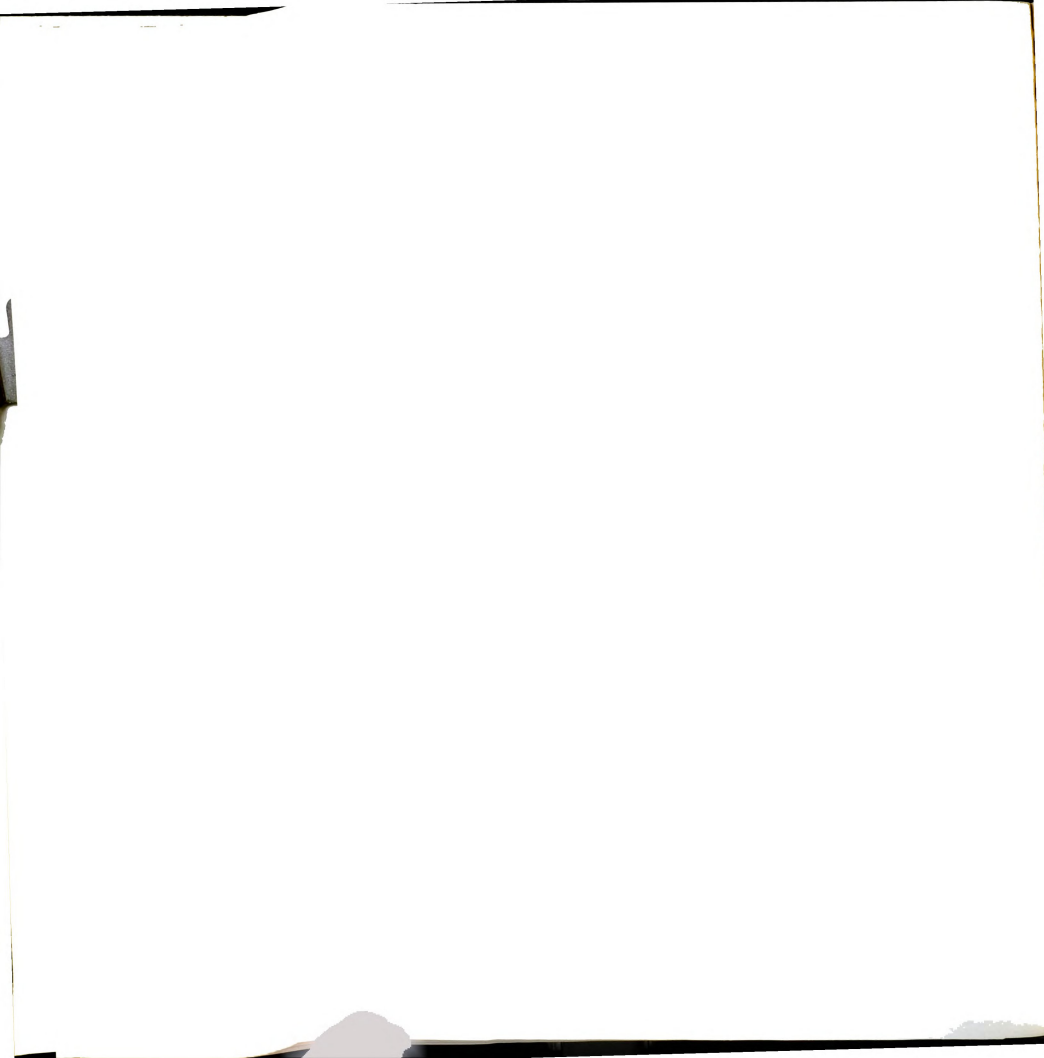


hypothesis 2

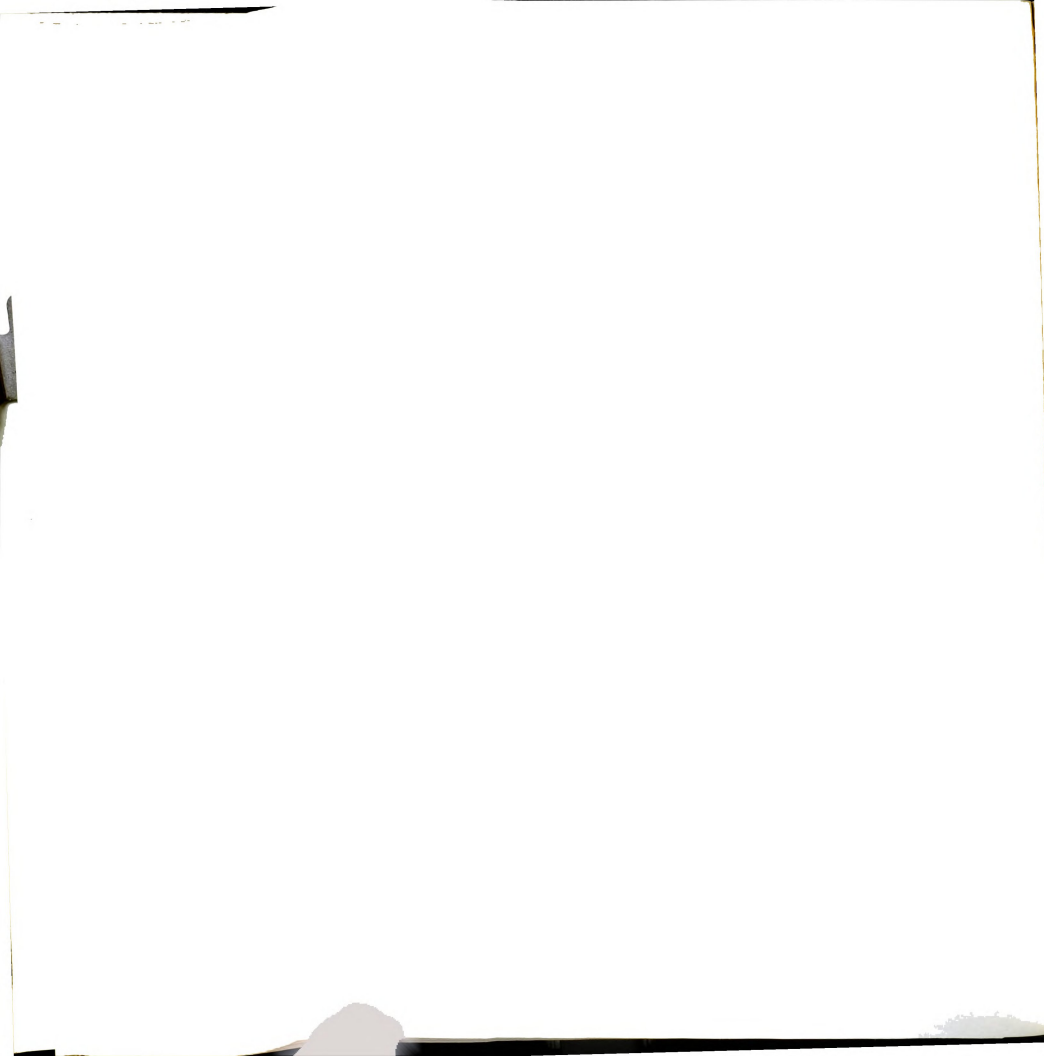
With respect to the variability of fertilizer supply and its impact on the fertilizer distribution system it was stated that:

Uncertainty and the variability of fertilizer imports account for major inefficiencies in the distribution of fertilizer in West Pakistan.

Considerable instability in the availability of imported fertilizers leads to fluctuations in the overall supply. The variations in the supply of imported fertilizers may, however, arise from inadequate allocation of foreign exchange, delayed action by governmental departments, and inaccurate timing of fertilizer imports. A brief analysis in the foregoing chapters indicated that ill-timed supply of imported fertilizers to meet seasonal demand tends to create market surpluses and deficits resulting in considerable variations in the equilibrium fertilizer price which would set forth such positive and negative market forces as may tend to raise or oppress the officially fixed retail price. Thus temporal variations in the supply of imported fertilizers give shocks to the internal distribution system and tend to create market inefficiencies in the movement of fertilizers. Late fertilizer deliveries tend to turn away some of the indifferent customers and generate losses in terms of fertilizer caking, storage costs until next season,



and slower expansion of the fertilizer market in general. Quantitative variability in fertilizer imports may arise from inaccurate assessment of demand in the domestic fertilizer market, inadequate allocation of foreign exchange, and some unpredictable events that may take place in the international fertilizer market. Since the internal distribution system depends for its success on in-time availability of fertilizers, speedier movement of imported fertilizers to the various distribution centers would tend to minimize losses resulting from a slowly contracting demand which may, in turn, arise from the non-availability of fertilizers or higher free market prices. It would, therefore, be desirable that the fertilizer transportation system be related to the distribution system in order to reduce the spatial variations in supply. Fertilizer imports must be tailored to the internal demand with some allowance for safety stock to meet the unpredictable demand and must be well-scheduled so as to avoid exorbitant demands on the transportation and distribution system generated by the ill-timed arrival of fertilizer imports. Since a remunerative fertilizer pricing system is closely tied up with various equilibrium levels resulting from the interaction of the market forces of fertilizer supply and demand, elements of risk and uncertainty must be eliminated in order to ensure timely availability of imports. The competitive strategy of private fertilizer distributors, however, receives a setback to the extent government



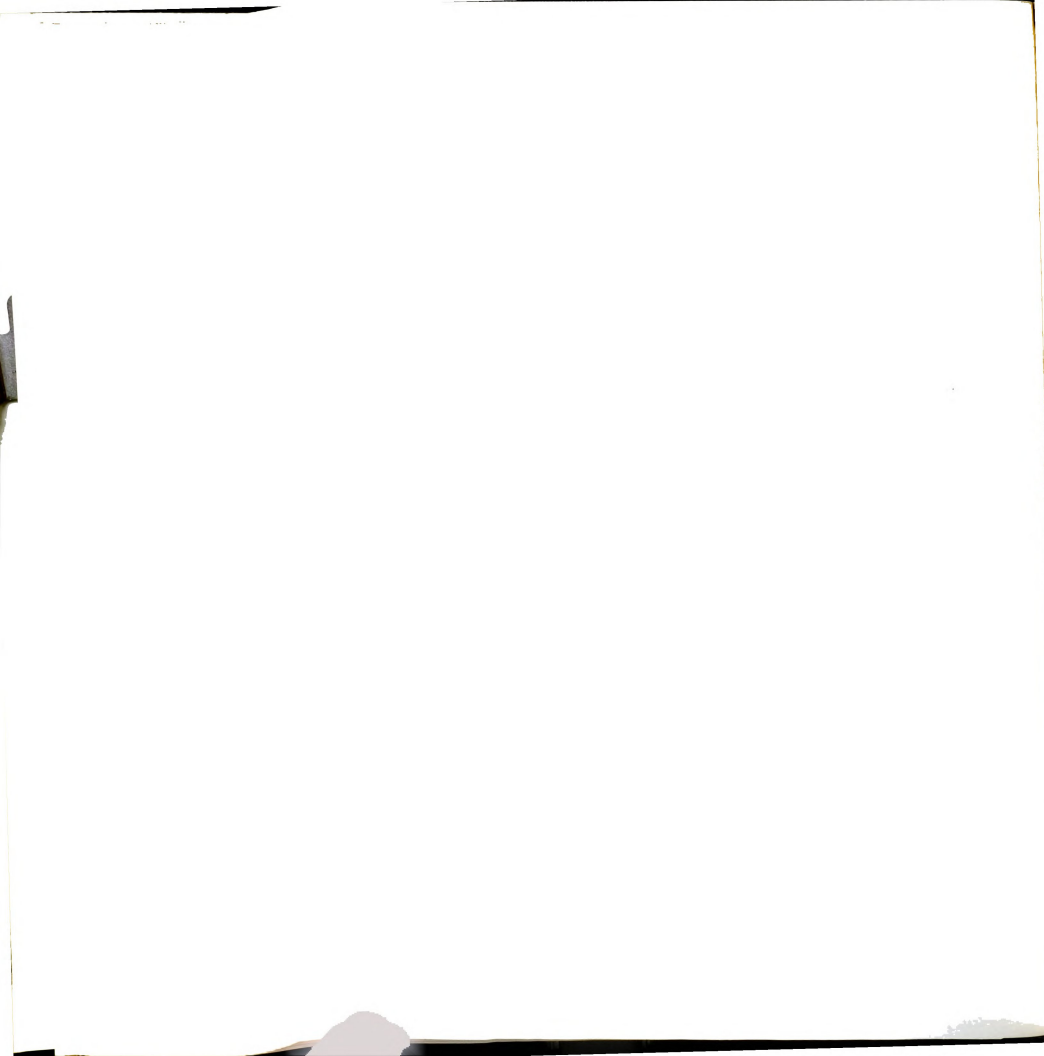
controls the supply of imported fertilizers. Thus a judicious use of this monopoly power would be necessary to ensure a fair competition among rival distributors.

hypothesis 3

In relation to the productivity of fertilizer in stimulating greater crop production wherever fertilizer use is higher it was stated that:

Diversity in the growth rates of various agricultural regions of West Pakistan may, in part, be attributed to the level of fertilizer use per acre.

An estimation of the growth rates of agriculturally advanced districts of West Pakistan shows that the growth rate in the districts of Lyallpur, Montgomery, and Multan is much higher than the rest. Disaggregation of growth into acreage, yield, cropping pattern, and interaction effects shows that increased yield accounted for 55 to 70 percent of the agricultural growth in these districts. The data on the level of fertilizer use per acre indicates, however, that fertilizer use is much higher in the aforesaid districts, because of the availability of complementary inputs like irrigation water, better seed, and due to the greater fertilizer consciousness of the farmers. The classification of various districts into three major groups indicated that the inter-group variation of growth rates has an apparent correlation with the level of fertilizer use per acre.



Thus, the hypothesis that the per acre fertilizer consumption does make a difference in the rate of agricultural growth is supported by the data in Table 8.1.

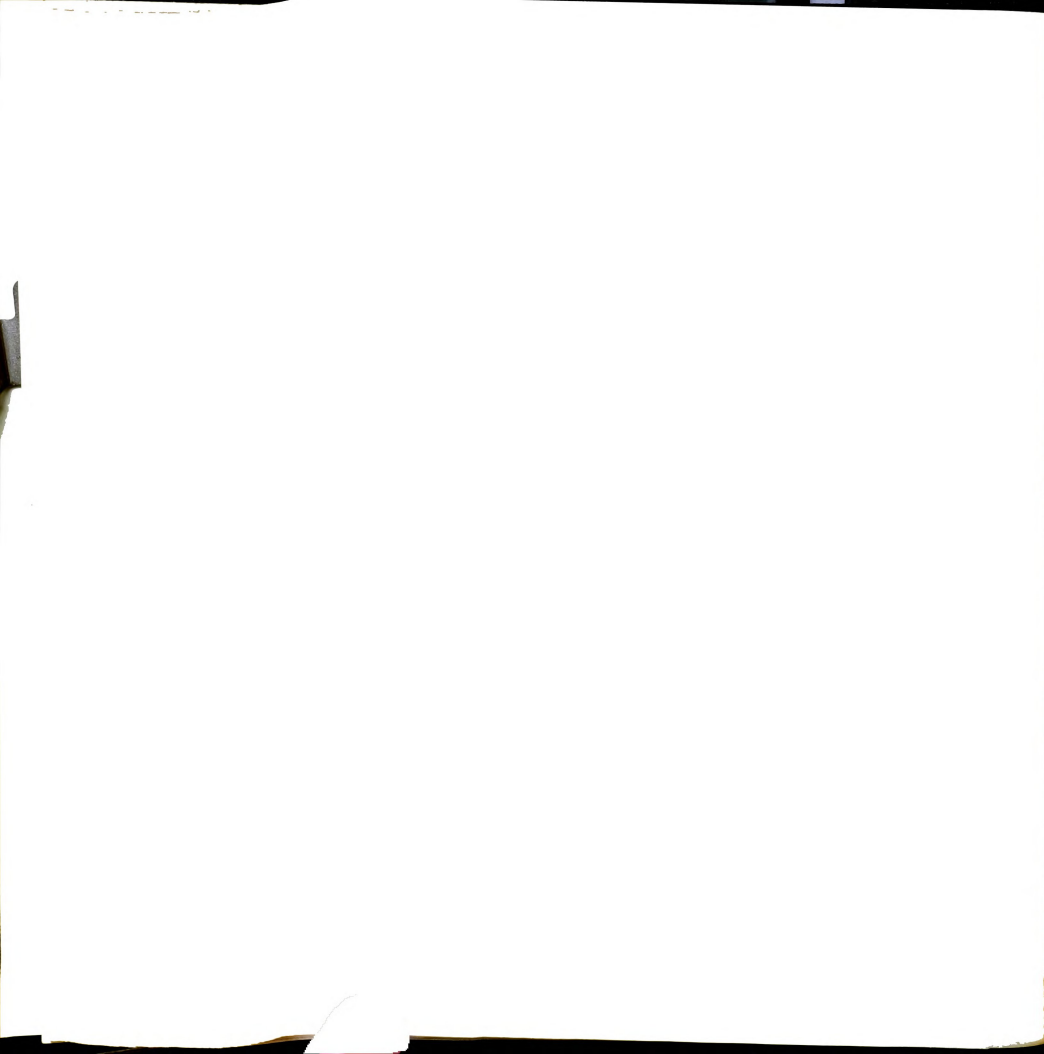
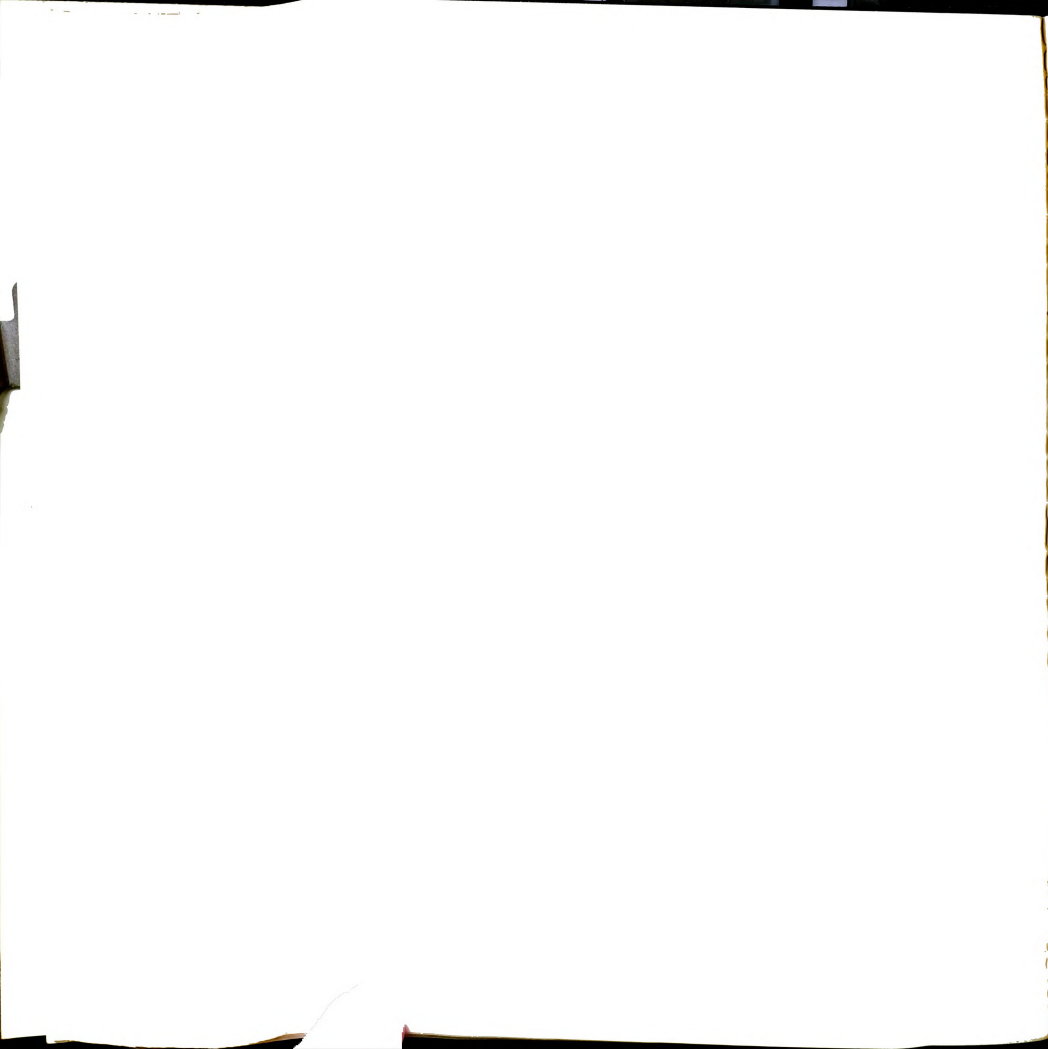


TABLE 8.1. Inter-District Variation of Growth Rates in Agriculture and Fertilizer Use Per Acre, 1960-65.

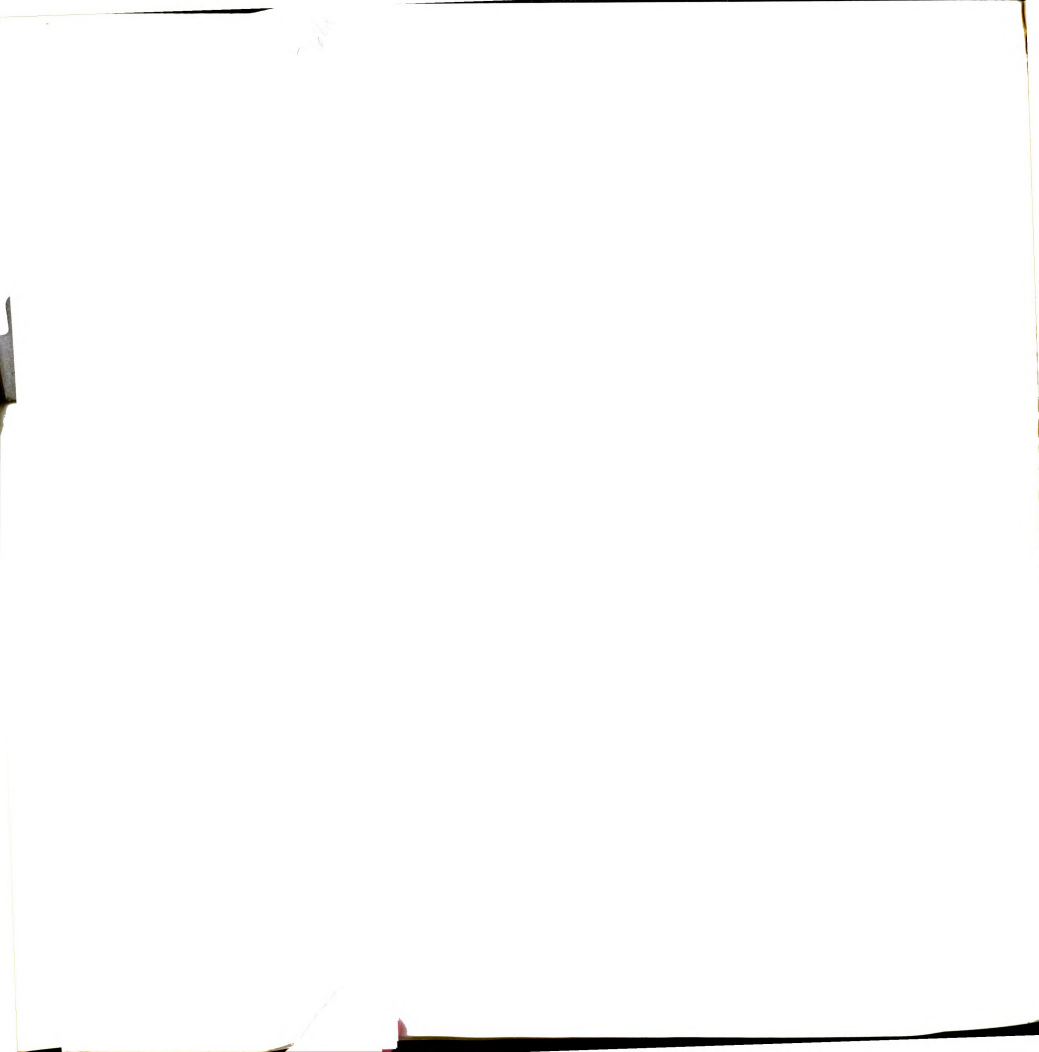
Districts	Growth Rate (GVP)	Acreage Effect	Yield Effect	Cropping Pattern	Inter-action	Fertilizer Use (per acre)
Group I: Stagnating Districts						
Jhelum	-2.4					1.66
Gujrat	2.2					0.87
Sialkote	-1.2					5.43
Rawalpindi	1.0					0.57
Campbellpur	-2.2					0.26
Mianwali	3.2					8.21
Sargodha	2.6					
Group II: Growth Due Primarily to Yield Effects						
Lyallpur	9.6	9.0	71.5	10.0	9.5	26.62
Montgomery	8.4	15.7	61.8	16.3	6.2	23.61
Multan	8.2	23.8	65.2	6.8	4.2	20.86
Group III: Growth Due Primarily to Acreage and Cropping Pattern Effects						
Lahore	4.9	48.5	34.8	9.1	7.6	17.45
Sheikhupura	7.9	47.2	44.4	7.0	1.4	13.43
Gujranwala	6.2	47.0	45.9	5.1	2.0	14.76
Jhang	8.1	39.1	51.3	6.9	2.7	11.02

Sources: (1) Government of West Pakistan, Planning and Development Board, Bureau of Statistics, "Performance Statistics of West Pakistan," Quarterly Bulletin, April, 1969.

(2) Government of Pakistan, Ministry of Food and Agriculture, Department of Agricultural Statistics, Land and Crop Statistics of Pakistan, 1962.

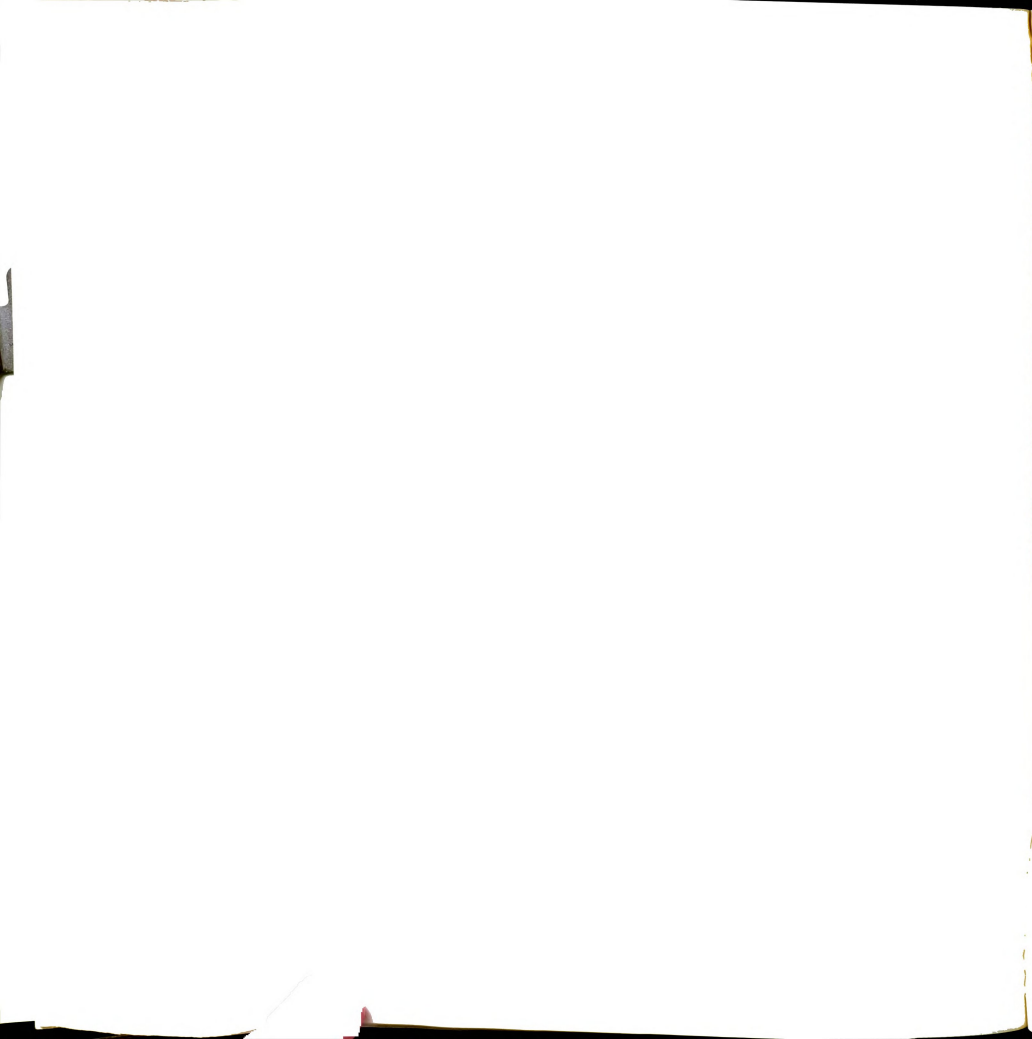


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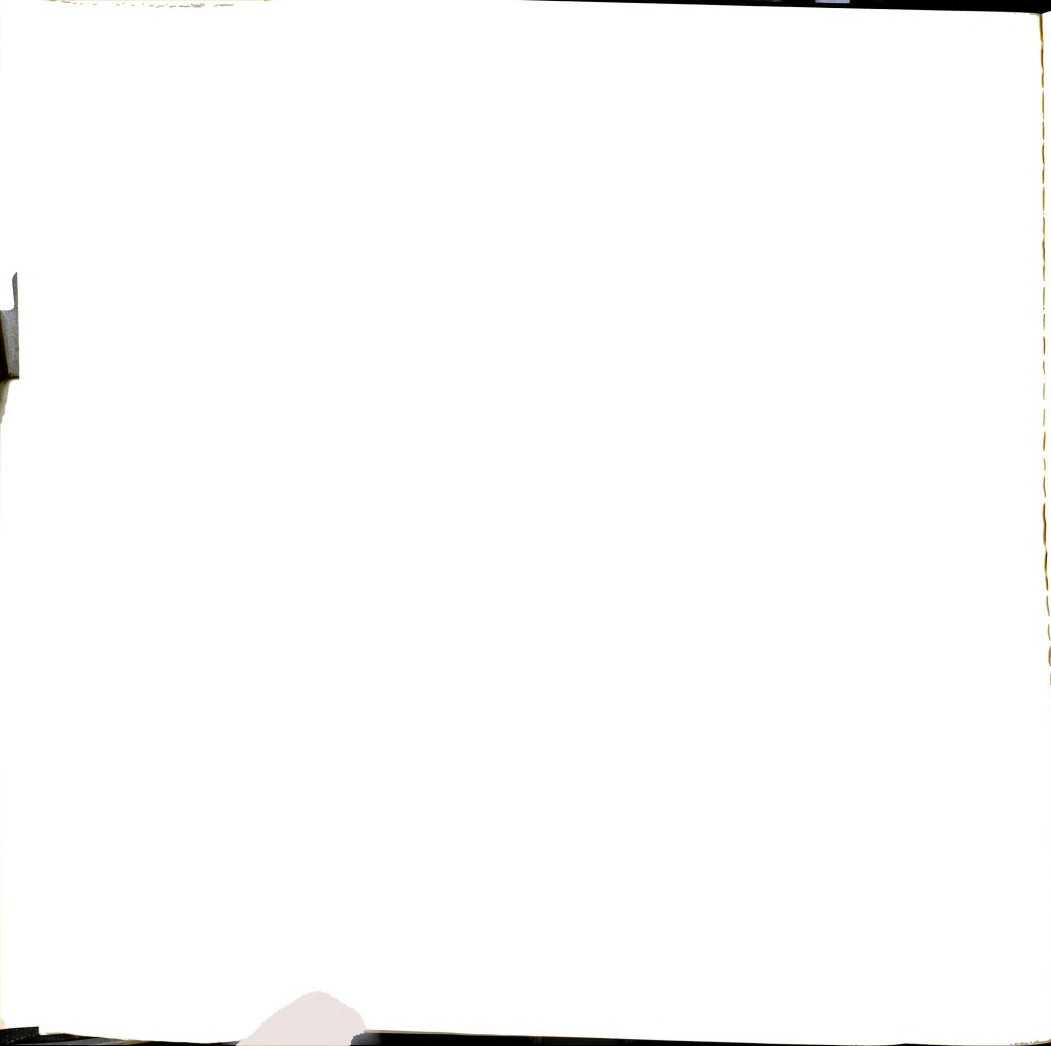
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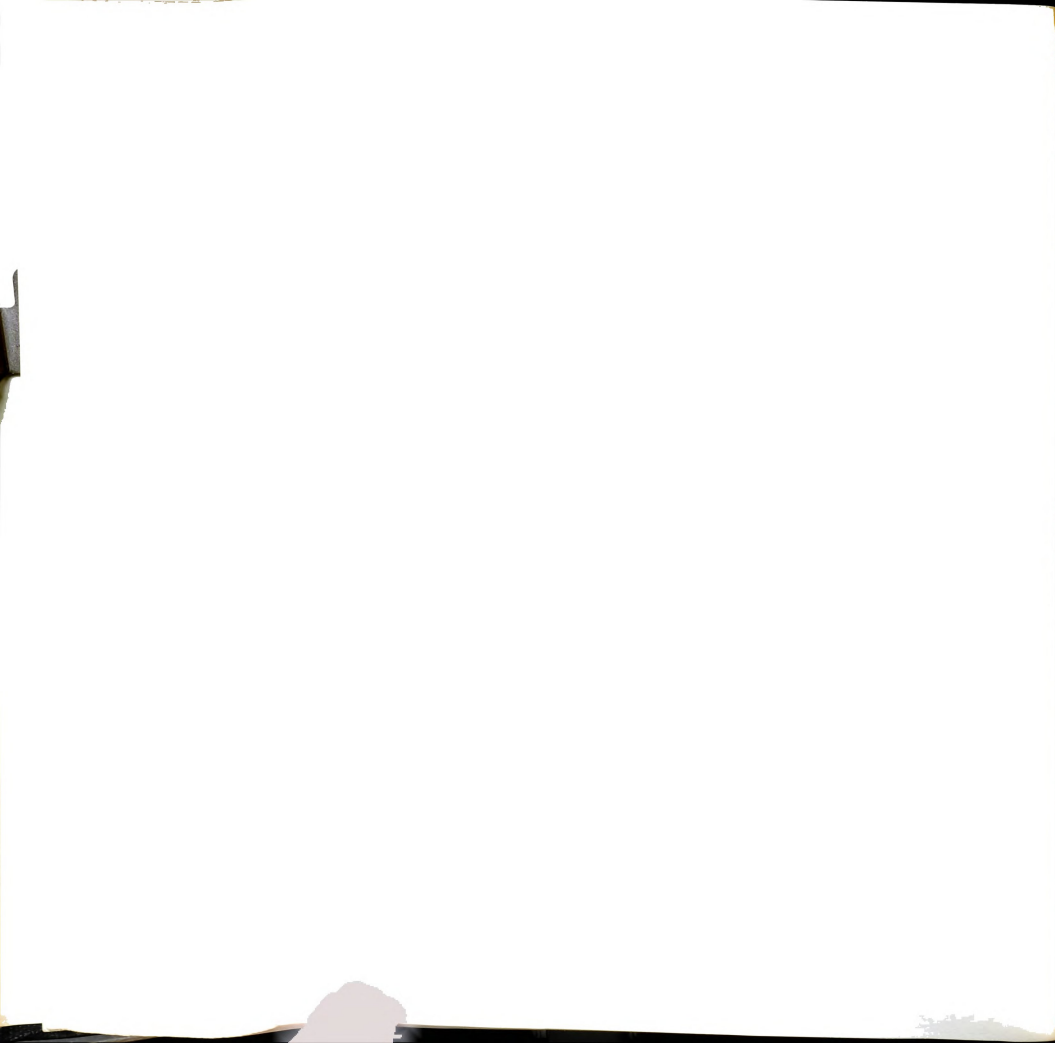
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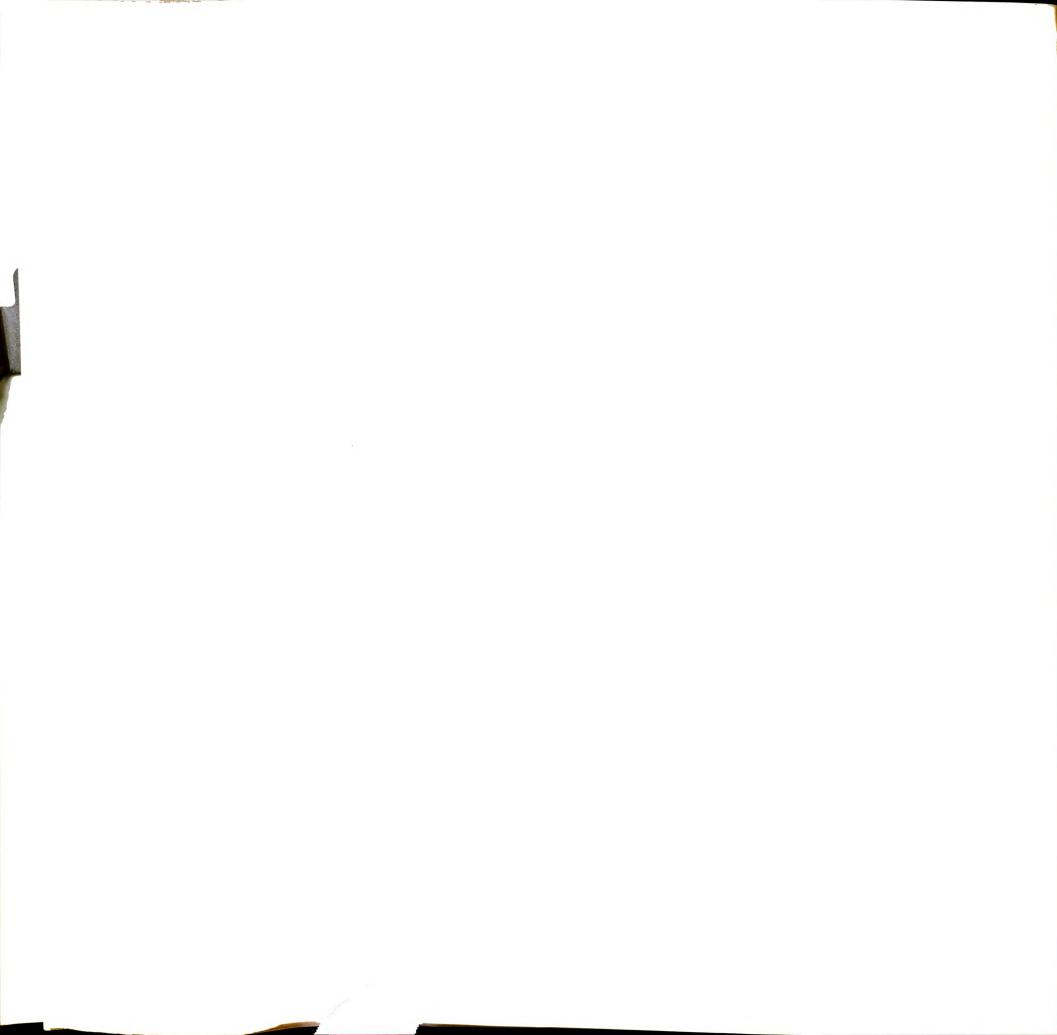


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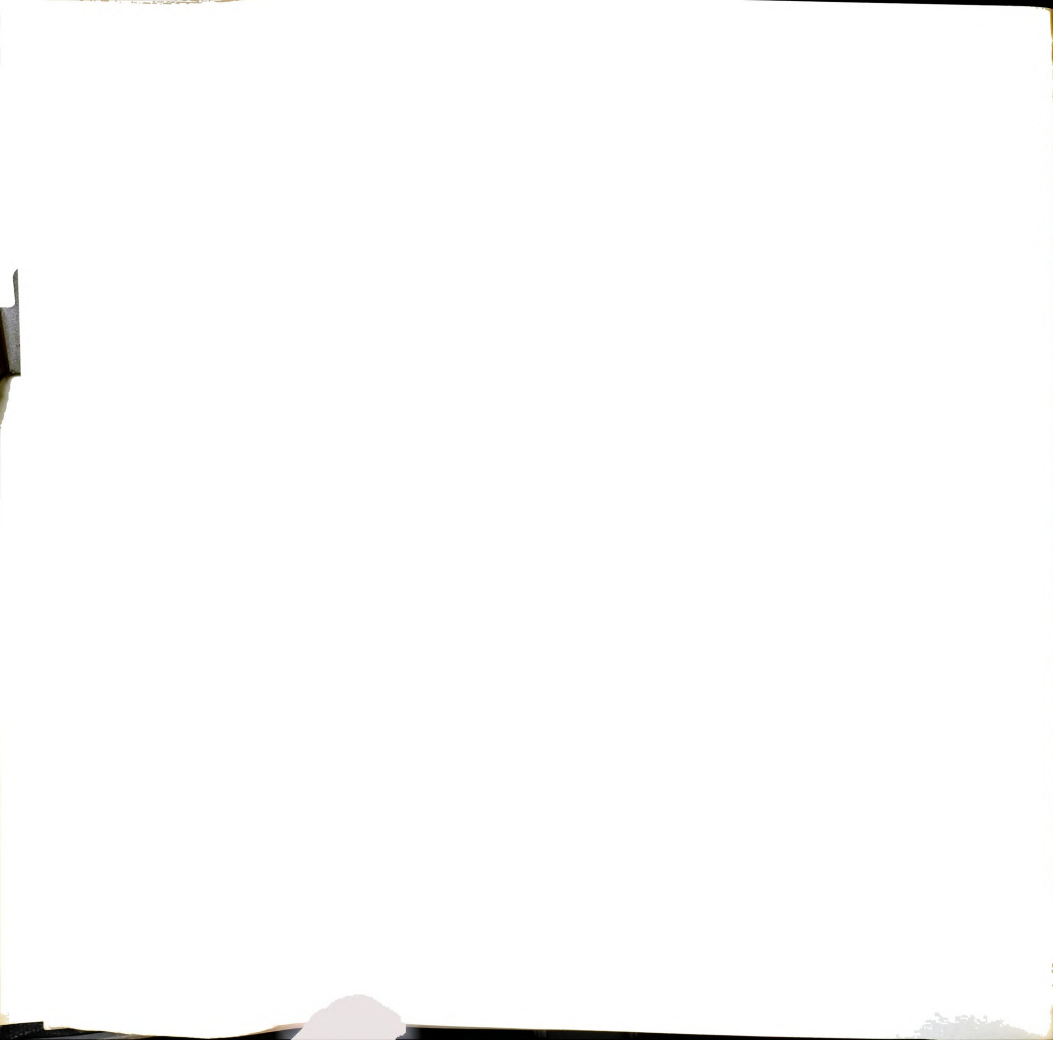
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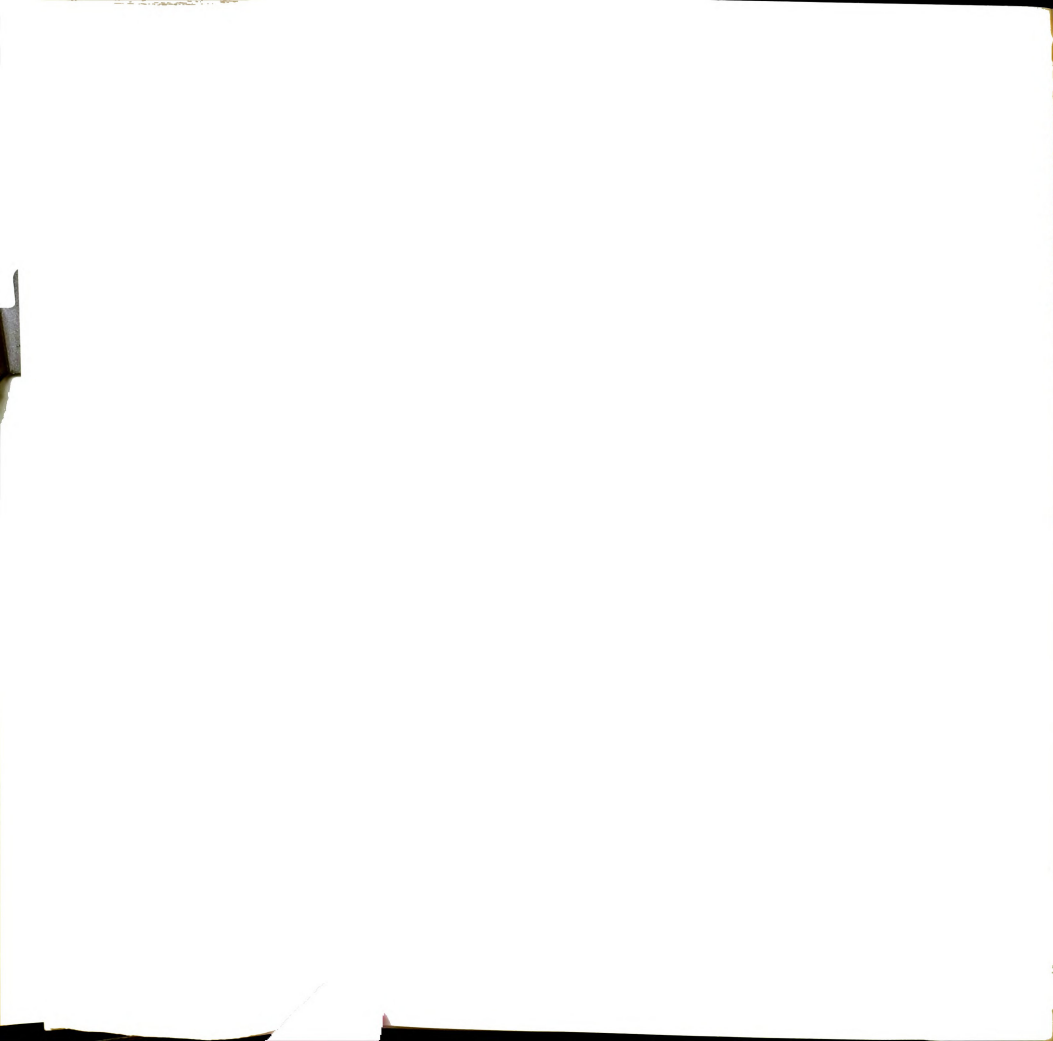
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APPENDICES

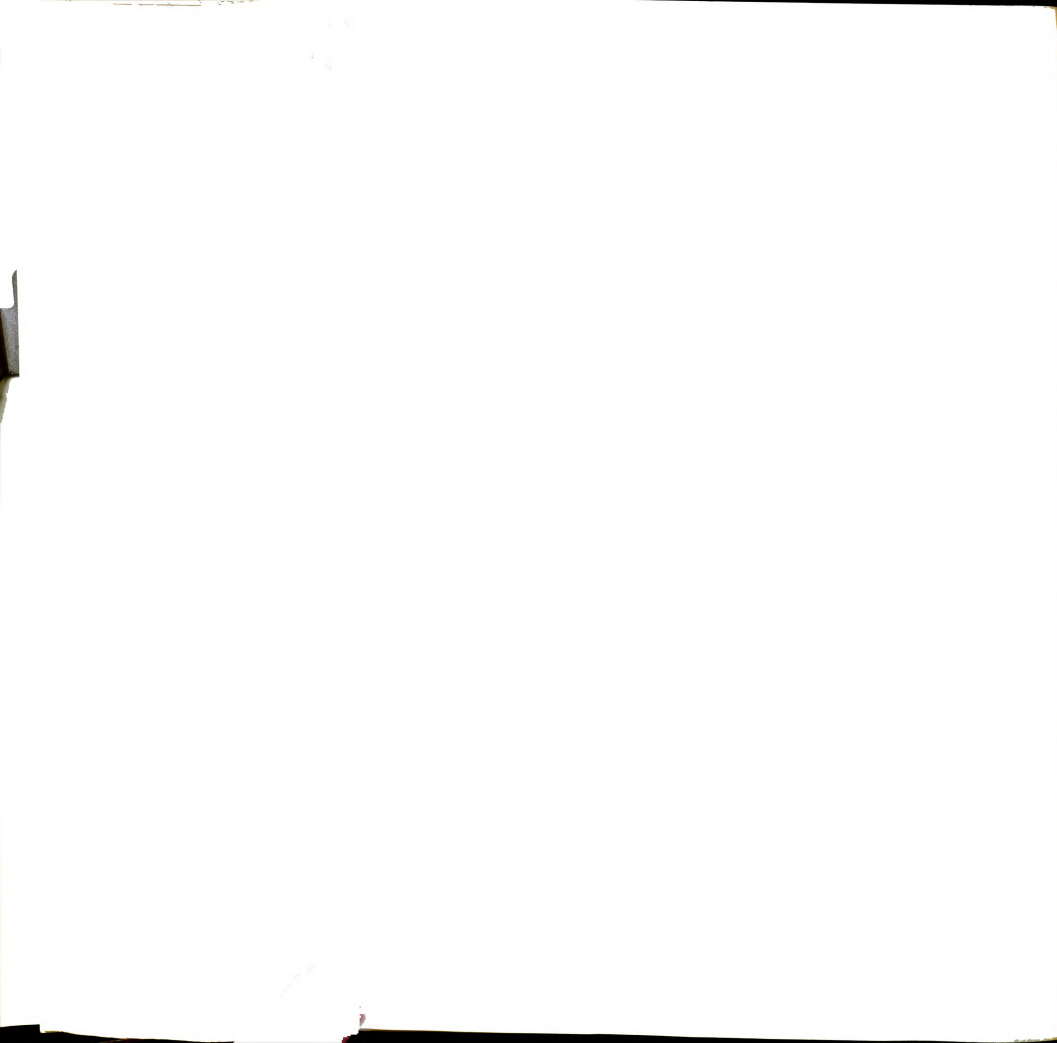


TABLE A-1.--Assumptions Underlying the Regional Demand for Fertilizer in West Pakistan.

Crops	Total Area (million acres)		Area Likely to Receive Fertilizer	Dose per Acre (lbs. per acre)		Total Fertilizer Requirement ("000" nutrient tons)			
	Irrigated	Unirrigated		Total	N	P	N	P	Total
1. Wheat	11.00	4.50	15.50	10.45		200	99	299	
a. Dwarf variety on 85% of irrigated area				9.35	123	192	96	288	
b. Indigenous variety on 2/3 of remaining irrigated area				1.10	6	8	3	11	
2. Maize on 66% of irrigated area	1.20	0.30	1.50	0.80	34	23	12	37	
3. Rice	3.80	.	3.80	3.22		63	32	95	
a. Dwarf Basmati on 80% of area			1.60	1.28	23	26	15	19	
b. Ordinary Basmati on 80% of area	0.40	.	0.40	0.32	16	4	2	6	
c. Irri rice on 90% of area	1.80	.	1.80	1.62	23	33	17	50	
4. Cotton	.	.	4.00	1.78	.	29	8	37	
a. American variety on 50% of area	.	.	3.55	.	10	29	8	37	
b. Desi variety	.	.	0.45	.	.	.	.	.	
5. Sugarcane	.	.	1.50	1.28	14	33	8	41	
6. Oilseeds on 75% of irrigated area	0.75	0.85	1.60	0.56	16	5	2	7	
7. Fruits and vegetables	.	.	.	.	26	26	11	37	
8. Others	.	.	.	.	.	155	42	197	
Total	.	.	.	.	.	536	214	750	
Potash	.	.	.	.	.	.	.	50	
Grand Total	.	.	.	.	.	.	.	800	

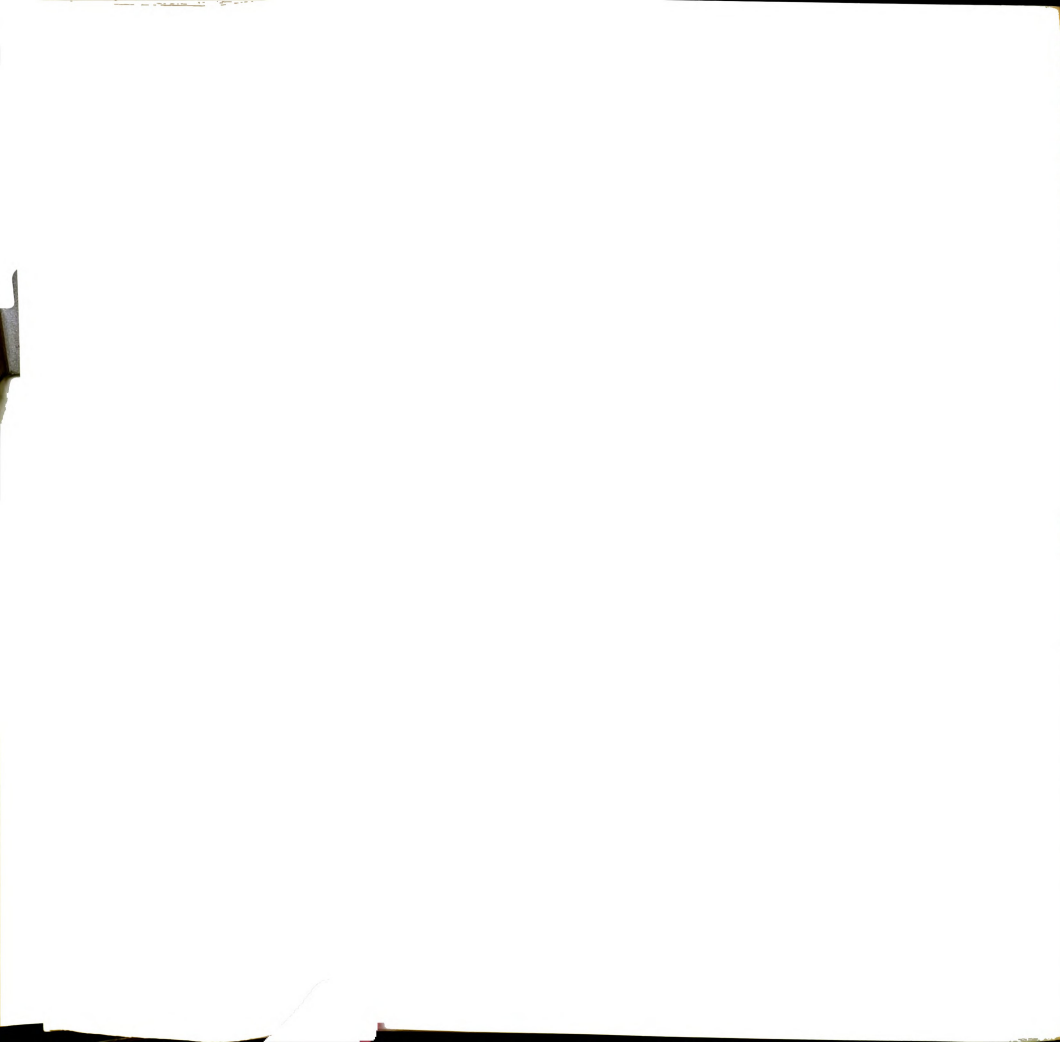
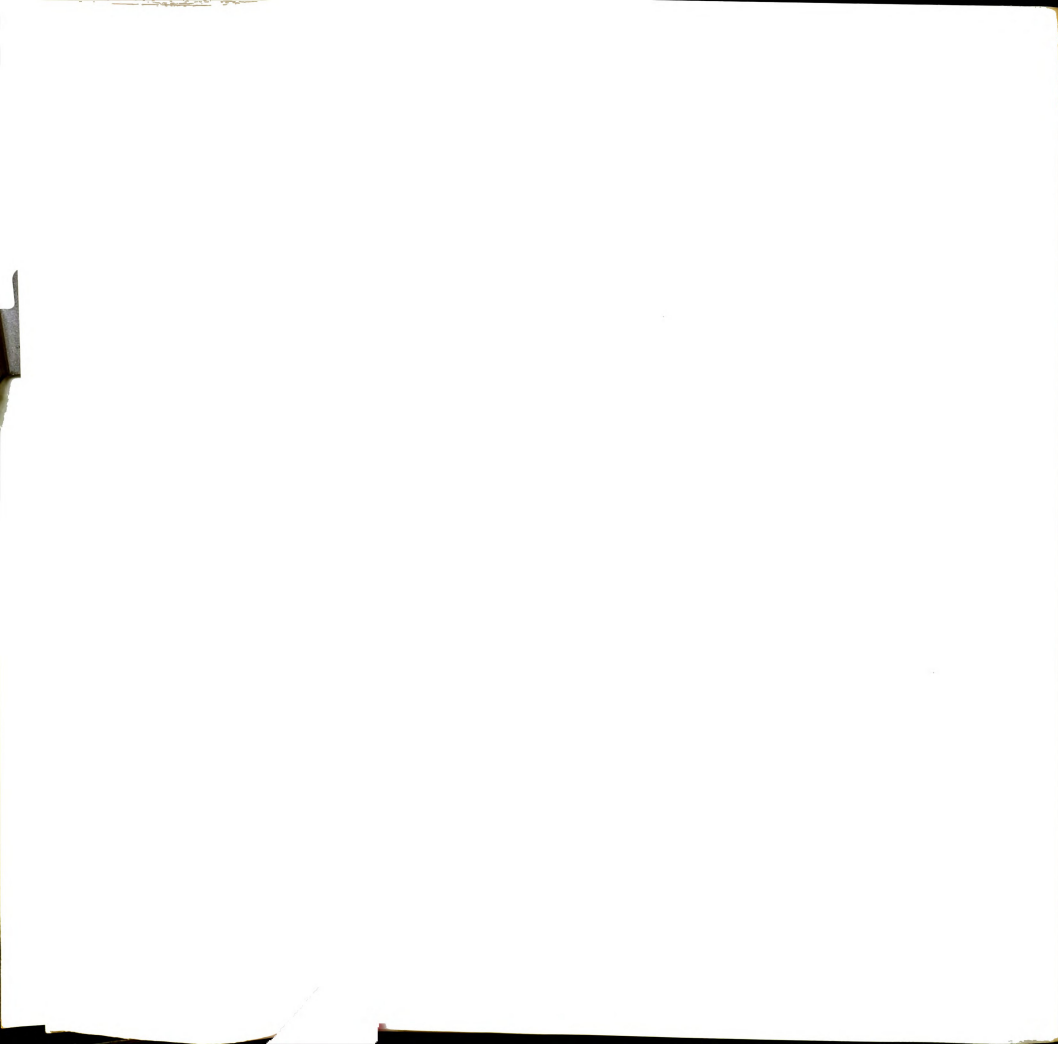


TABLE A-2. Nitrogen Fertilizer Consumption per Capita and per Acre in Selected Countries, 1961.

Country	Nitrogen Consumption per Capita (in pounds)	Nitrogen Consumption Per Acre (in pounds)
The Netherlands	43	193
United States	33	13
France	27	23
Taiwan	21	101
United Kingdom	19	56
Japan	18	111
Egypt	14	55
Philippines	2	3
India	1	1
Pakistan	2	2

Source: Food and Agriculture Organization, Production Yearbook (Rome: United Nations, 1961).











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