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ANNUAL REPORT: PHASE ONE OF THE FARM EFFICIENCY ACTIVITY

By
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ANNUAL REPORT

PHASE ONE OF THE FARM EFFICIENCY ACTIVITY

February 1982

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INTRODUCTION

This report summarizes the research conducted by the Farm Efficiency Activity of the Arab Republic of Egypt--Univeristy of California--AID Economics Sub-project during February 1981-January 1982. This first phase of the Farm Efficiency Activity assembles data, surveys agricultural policies concerning input use and production of major field crops, and provides a preliminary empirical analysis of the effects of these policies on individual farmers' production decisions and on overall agricultural productivity. The empirical analysis of this first phase is based on single-product cost and profit function estimation, and will serve as a basis for our further study of both single product and joint production models in the second phase of the activity.

The report begins with an Executive Summary and then is divided into three parts. Part I provides an overview of the general role of agriculture in the Egyptian economy and the importance of rice, cotton, wheat, and maize in Egypt and in the East Delta region studied in this report. Part II surveys important agricultural policies for inputs and major crops, and presents extensive aggregate production data for the period 1965-1979 for Egypt and the three East Delta governorates, Sharkia, Dakahlia, and Domiatte. Part III presents a theoretical analysis of the effects of agricultural policies on production and input decisions, and utilizes Ministry of Agriculture Farm Management Survey data, for the East Delta region, for the estimation of cost functions and profit functions. The input demand equations derived from these relationships are then utilized to study the economic behavior of farmers in the East Delta region. In addition, part III examines evidence on agricultural research and its relationship to agricultural productivity growth in Egypt during the past 15 years.

EXECUTIVE SUMMARY

Agriculture is the cornerstone of agricultural and economic development around the world. In Egypt agricultural income is 30 percent of national income, and 50 percent of agricultural income is based on field crops. In foreign trade agriculture is also very important and has a substantial effect on the balance of trade. Our study concerns major field crops--rice, cotton, wheat, maize--and examines agricultural policies for production and input use of these crops.

The theoretical and empirical analysis of Egyptian farm production conducted in Part III of this study suggests that farmers are economically rational, that is, they make economic decisions such as acreage and fertilizer allocations in an attempt to maximize their economic returns. This finding is supported by our empirical analysis of farm-level production in the East Delta which shows that farmers are very responsive to price changes in making their input decisions; similar results have been obtained in studies all around the world. As we discuss in detail below, these findings of farmer rationality suggest that a major effect of Egyptian agricultural policies, such as price policies, input quotas, production quotas, and marketing programs, has been to discourage production and productivity growth in major Egyptian crops. One result of these policies is that Egyptian agriculture is now in a "semi-traditional" state which is characterized by a little or no productivity growth. Since arable land is fixed in total quantity, Egyptian agriculture will be unable to provide for the needs of a growing population. This failure of agricultural production to grow at a rapid rate, we believe, is due in large part to agricultural policies which effectively tax, or penalize, farmers for producing major crops, and to inadequate development and diffusion of effective new production technology.

Our findings have clear implications for the general crop rotation system in Egypt. Due to conflicting production, input, and marketing policies, the crop rotation system discourages increased specialization and intensification of production of the major Egyptian field crops studied in this report, and effectively reduces overall agricultural productivity. A perfect example of this phenomenon is the effect of agricultural policies on fertilizer use. By discouraging the application of fertilizer to the major crops such as cotton and rice, and by encouraging farmers to allocate fertilizer to secondary crops such as vegetables, these policies are inhibiting increased production efficiency through specialization in production. Rather than encouraging specialization and productivity growth through the managed crop rotation system, Egyptian agricultural policy appears to have an adverse effect on overall productivity of Egyptian agriculture through despecialization of production.

Cotton is a basic component in the crop rotation throughout Egypt, except in the regions specializing in sugarcane and rice production. Our study shows that the substantial reduction in area and production of cotton during 1965-1979 is due to high costs of production and reductions in farm prices for cotton to the degree that cotton is not profitable relative to other crops. Since Egyptian farmers are economically rational, they have tried to reduce acreage and production of cotton and to substitute other crops in its place. Deficiences in cotton marketing organizations and lack of coordination among components of the marketing system also discourage farmers from producing cotton. Our findings suggest that the cotton price policy, in conjunction with other crop prices in the crop rotation, should change to be consistent with input price policies. The cropping pattern also must be changed and the cotton area must be determined according to local consumption needs, the capacity of cotton processing facilities, and the international demand for Egyptian cotton. Our study also suggests that cotton export prices must be linked to farm prices so that farmers have a greater economic incentive to produce cotton. We find that the net return to cotton is less than in other field crops, especially vegetables; this again shows that the price policies and other input policies, quotas, and regulations must be changed to encourage cotton production.

Wheat is a basic crop for human nutritional needs, and Egypt depends on foreign trade for 75 percent of local wheat consumption. Wheat area has been roughly constant over the study period 1965-1979, largely due to costs of production which have increased at a faster rate than the price of wheat to farmers. We find also that frequent changes in marketing policy have had a negative impact on wheat production. There appears to be a need for new seed varieties which are more appropriate under growing conditions in Egypt and the farm technology which is currently in use in Egypt. Price policy for wheat must also be changed to encourage production of wheat. The current policy of subsidized bread and flour through subsidized wheat imports has had the effect of decreasing wheat prices and discouraging local wheat production. To illustrate the degree of this problem, we note the frequent practice of subsidized bread being fed to livestock in the rural sector. One alternative policy would be a price support program for local wheat production. The price and marketing policies for wheat also must be made consistent with policies for other crops in the rotation such as maize which are affected indirectly by wheat policies. These policies have had the effect, for example, of changing rural consumption from maize bread to wheat bread and have led to maize being fed to animals.

Maize is a major consumption crop in the rural sector of Egypt, and it is a major source of green forage for animals in summer. We find that the area of maize cultivated has increased slowly from 1965-1979 and total production has not increased significantly. Costs of production have increased while the price received by farmers has declined. However, the cropping pattern for maize and related crops (especially rice which competes for area with maize) is inconsistent with the cost and price trends that have taken place and must be made consistent with the other policies affecting these crops. The price decline for maize appears to be due in part to the subsidization of wheat and substitution in consumption of wheat for maize. This has occurred because maize is traded primarily in local markets in the rural sector. Therefore, to encourage local production of both wheat and maize, we suggest that the government reduce subsidized wheat imports and provide farmers with higher prices for both wheat and maize. For example, government price support programs for maize could be used to provide subsidized maize flour and bread to consumers in addition to the wheat flour and bread that are currently subsidized.

Rice is an increasingly important crop in both local consumption and exports. However, Egypt may soon need to import rice after having exported rice for many years. Rice area and production have increased slowly and yield has increased slowly in comparison to other countries. Again, as with other crops, rice production, price, and consumption policies are conflicting and inconsistent. While further study of these policies is needed, several conclusions are apparent. Farmers now receive a low price for rice from the government which is less than the market price, and this leads to a black market for rice. There is also a need for improved rice marketing and better organization of marketing services. Finally, agricultural research to create more productive rice varieties is sorely needed in order to increase rice yields in Egypt.

The study finds that, in general, high production costs are due in large part to high labor costs, and this suggests that policies are needed which make machinery available which can substitute for labor, especially in operations such as threshing and harvesting. Such machinery should be available through village cooperatives and imports through the private sector should be encouraged, perhaps through tax incentives.

Fertilizer is a very important input in agricultural production in Egypt. Our study examines local production, imports, and consumption of fertilizer. Due to increasing demand for fertilizer and limited local production capacity, increased imports will be needed in the future. The government therefore should pursue policies to encourage local production of fertilizer, perhaps through permitting private industry to undertake fertilizer production. We also find that fertilizer distribution is often inefficient due to inadequate storage, handling, and transport facilities. Consequently, farmers often cannot obtain fertilizer at the appropriate time and as a result agricultural production is reduced. Another major problem concerns the inappropriate input quotas allowed by the government, often because the quotas do not account for differences in conditions across regions and changes in fertilizer needs over time.

Seeds are a basic input in crop production and their cost has increased along with other factors of production. Major seed production problems are due to poor communication between farmers and the Ministry agency responsible for seed production. Better agricultural research is needed to develop more productive seed varieties which are appropriate under actual farm conditions in Egypt.

Our economic analysis of pesticides, as suggested above in the context of cotton production, shows that pesticides may often not be economically beneficial to farmers. Therefore, the Ministry is strongly recommended to reconsider its policies concerning pesticide use.

Part I

THE ROLE OF AGRICULTURE IN THE EGYPTIAN ECONOMY

Agriculture is a major industry in Egypt and a large part of the population depends on agriculture for its livelihood. Agriculture accounts for a high percent of the national income and is an important source of raw material for other industries. The value of agricultural income from 1976 to 1979 averaged 2,189 million L.E. annually representing 25.4 percent of the 8,627 million L.E. annual national income in Egypt. The agricultural population represented about 55.9 percent of the total population of Egypt in 1975. For the period from 1972-1976, the average number of workers in agriculture was about 4.19 million representing 45.8 percent of the total 9.13 million workers in Egypt. The agricultural sector consists of plant and animal production. Plant production represented 73 percent or 1,815 million L.E. and livestock represented 27 percent or 872 million L.E. of the value of agricultural production for the period. Agriculture supplies other industry with human resources and raw material. The elements of agriculture production are used in various industrial products. Workers in industries using agricultural products as raw materials account for 60 percent of total industry employed. The agricultural population is also a major consumer of industrial goods.

1.A. Agricultural Income

In 1965 the agricultural net income and value of agricultural production totaled L.E. 612,801 miilion representing 30.9 percent and 40.56 percent of the L.E. 1975 million national income, respectively. Agricultural income has been a fairly constant percentage of the national income. In 1977, the agricultural net income and value of production totaled L.E. 2,189 and 3,250 million or 29.5 percent and 39.7 percent of the L.E. 6,613.7 million national income (see Table 1-1).

In 1965 the value of field crops, vegetables, and fruits, represented 59.5 percent, 9.74 percent, and 4.62 percent, or 473, 78, and 37 million L.E. of the total value of agricultural production (801 million), respectively. For the same year, livestock for 212 million L.E. or 26.74 percent of the total value (see Table 1-2). In 1978, the total value of field, vegetable, and fruit amounted to 1,799, 410, and 172 million L.E. which represented 55.35 percent, 12.62 percent, and 5.2 percent of the total value of agricultural production of 3,250 million L.E. Livestock accounted for 847 million L.E. or 26.06 percent of that value. The figures show a relatively stable concentration of commodities in the composition of the value of agricultural production. In 1978, the values for cotton, wheat, maize, and rice were 276, 225, 247 and 162 million L.E. which represented 8.5 percent, 6.9 percent, 7.6 percent and 5 percent of the total 3,250 million L.E. value of agricultural production (see Table 1-3).

1.B. Acreages of Major Field Crops

A study of the acreages for cotton, wheat, maize, and rice indicates that the cultivated area for these crops was 1,900; 1,144; 1,451; and 1,191 in thousands of feddans in 1965. These findings represent 18.5 percent, 11.2 percent, 14.1 percent and 11.6 percent of the total cultivated area of agricultural crops in Egypt (10,261 thousand feddans) in 1965, respectively. In 1979, the cultivated areas for cotton, wheat, maize and rice were 1,196; 1,391; 1,885; and 1,040 in thousands of feddans. These figures represent

10.7 percent, 12.4 percent, 16.8 percent and 9.3 percent of the total cultivated area in agricultural crops, respectively (see Table 1-4).

Cost and Net Return for the Major Field Crops

Table 1-5 displays costs and net returns for the major field crops in Egypt from 1970-1979. In 1970, the cost per feddan of cotton was estimated to be 51.54 L.E. while the net return per feddan was 51.35 L.E. In 1979, the cotton cost per feddan was estimated to be 141.75 L.E. and the net return was 192.31 L.E. The wheat cost per feddan was estimated to be 39.94 L.E. and the net return was 19.29 L.E. in 1970. In 1979, the cost and net return for wheat were 97.71 and 48.93 L.E., respectively. In 1970, the cost per feddan for maize was 41.5 L.E. and the net return was 19.9. In 1979 the cost per feddan increased to 102.93 L.E. while the return was only 38.7 L.E. The rice cost per feddan was 36.8 L.E. compared to a net return of 30.24 L.E. in 1970. The cost and net return per feddan in 1979 were 101.73 L.E. nd 68.81, respectively.

1.C. Egyptian Export and Import Structure

Egyptian agricultural exports are important to the whole structure of Egyptian exports. This is true primarily with respect to the major exporting crops of cotton, rice, onions and potatoes. The total value of Egyptian exports in 1965 was 263.132 million L.E. Agricultural exports comprised 68.9 percent or 181.4 million L.E. of that total. In 1979, the total value exported was 1,287.8 million L.E. of which agricultural exports accounted for 377 million or 29.3 percent (Table 1-6).

The cotton exports in 1965 totaled 146.2 million which amounted to 55.6 percent of the total Egyptian and 80.6 percent of agricultural exports.

In 1979 the cotton report figure was 267.3 million L.E. or 20.8 of the total Egyptian and 70.9 percent of agricultural exports.

The contribution of rice exports in 1965 amounted to 19.8 million L.E. or 7.5 percent and 10.9 percent of the total Egyptian and agricultural exports, respectively. In 1979 the rice export total was 22.1 L.E. million which represented 1.7 percent and 5.9 percent of the total and agricultural exports. Onion exports were 6.8 million L.E. in 1965 ad 8.4 million in 1975. These figures represent 2.6 percent, 3.8 percent, .7 percent, and 2.2 percent of the total Egyptian and agricultural exports in the respective years.

The last of the major export commodities is potatoes. In 1965, potato exports totaled 1.2 million L.E. or .5 percent and .7 percent of the total and agricultural exports, respectively. In 1979, the figures were 18.8 million L.E. value of exports representing .5 percent and 1.5 percent of the total and agricultural exports.

Agricultural imports have displayed a declining trend in relative importance in terms of total Egyptian imports. In 1965, total Egyptian imports amounted to 409.5 million L.E. Of that amount agricultural imports represented 538 million L.E. of 20.44 percent.

Wheat and maize are the two major agricultural commodities imported (Table 1-7). In 1965 wheat imports totaled 61.7 million L.E. This value accounted for 15.2 and 55.99 percent of the total and agricultural imports, respectively. The percent figures show a decline in 1978 to 9.17 and 44.76 for total and agricultural imports but the value was substantially higher at 240.8 million L.E. Maize imports accounted for 3.5 million L.E. or 1.2 percent a 3.8 percent of the total Egyptian and agricultural imports in 1965. The figures did increase in 1978 to 38 million L.E. or 1.44 percent and 7.06 percent of the total and agricultural imports, respectively.

Part II

AGRICULTURAL POLICY FOR MAJOR CROPS: COTTON, RICE, WHEAT, AND MAIZE

2.A. Input Policies

2.A.1. Fertilizers

Fertililzers are considered among the main factors of production and are important in increasing crop yields. The total value of fertilizer used in 1965 amounted to approximately 38 million which represent 6.2 percent and 20.1 percent of agricultural income and production requirements, respectively. In comparison, the total value of fertilizer used in 1978 amounted to 73 million which represented 3.3 percent of agricultural income and 6.9 percent of production requirements.

Trend regressions for the data in Table 2-1 show that the local production of N and P_2O_5 fertilizers has increased on average about 1.44 and 18.25 thousand tons yearly, respectively, or at average annual rates of 1 percent and 4.1 percent, respectively. The value of nitrogen has been decreasing annually at a rate of L.E. .001 million. This represents a change of .006 percent from the average value of nitrogen fertilizer (L.E. 16.89 million) used in production. The value of P_2O_5 fertilizer has increased annually L.E. 423.42 thousand or 7.75 percent of the average value of P_2O_5 fertilizers (L.E. 466.25 thousand).

The level of fertilizer imports has increased annually 1.6 percent or 6.87 thousand tons relative to the average quantity imported (424.01 thousand tons) in the period from 1965-1979. The value of fertilizer imports increased at a rate of 10.8 percent with an average value of 13.14 thousand during the same period. The quantity of fertilizers exported from 1965 to 1978 decreased at annual rate of 1.4 percent or 46.65 thousand metric tons. The value of exports decreased at an annual rate of .8 percent from the average value of L.E. 413.93 thousand during the period (Table 2-2).

The Value and Consumption of Fertilizer for Major Crops

The study of the value of fertilizer used in the 1965 production of the four major crops, maize, cotton, wheat, and rice, reveals the relative importance of this input in terms of average variable cost to the farmer. The value of fertilizer used per feddan in 1965 for maize, cotton, wheat and rice amounted to L.E. 3.6, 5.1, 4.3, and 4.2 or 16.2 percent, 12.1 percent, 18.6 percent, and 13 percent of average variable cost, respectively. In contrast, the value of fertilizers used in 1978 for these crops amounted to L.E. 10.5, 10.8, 9.1, and 7.5 which represents 12.9 percent, 9.2 percent, 13.9 percent, and 9.2 percent of average variable cost, respectively, (see Table 2-3).

During the 1969-1970 year data show that the consumption of nitrogen fertilizer totaled 380, 250, 242, and 455 thousand tons for cotton, rice, wheat and maize. For 1975 to 1976, the consumption totaled 446, 220, 463, and 772 thousand tons, respectively. The value of nitrogen consumed in the 1969 to 1970 year totaled L.E. 7,630, 5,029, 6,822, and 9,129 thousand for the four crops. The consumption totaled L.E. 8,947; 4,419; 9,293; and 10,279 thousand for 1975 to 1976. The consumption of P_2O_5 fertilizer amounted to 71 and 50 thousand tons for cotton and rice in 1970 and to 66, 58, and 74 thousand tons for cotton, rice and wheat in 1976. The value of P_2O_5 fertilizer totaled L.E. 861 and 614 thousand in 1970 for cotton and rice and 971, 839, and 1,086 thousand in 1976 for cotton and rice and wheat (see Tables 2-4; 2-5, and 2-6).

Fertilizer Policy

The first law for fertilizers was enacted in 1929. Many modifications were made in this law until Law No. 53 was imposed in 1966. Law 53 permitted only the government to produce and distribute fertilizers. However, in 1980 private interests were allowed to start importing fertilizers. The Ministry still establishes the quotas of fertilizer use for the crops.

For the period from 1973 to 1978, the quotas for wheat, rice, cotton, and maize were as given in Table 2-7. In addition to the quota, the government subsidizes fertilizer as shown in Table 2-8.

The agricultural Law No. 53 pertaining to quotas on fertilizer use was enacted to reduce the cost of fertilizers, preserve land quality and in time to help maximize potential crop production. Research has shown that nitrogen fertilizer is considered the main element in contributions to increased yields per feddan. The P_2O_5 element is considered to be second in importance in this respect in Egyptian agriculture. Consequently, the government has been working toward efficient use of fertilizers in the last few years. Some general considerations in determining fertilizer needs for the agricultural sector are:

1. Cropping patterns and nutrient differences among crops.
2. Plantings of new varieties characterized by high responses to fertilizers.
3. The effect of using organic fertilizers and the impact of previous crops and soil preparation.
4. Intensive agricultural practices involving increased plant population per feddan.
5. Extension of drainage and land preservation projects.
6. Equilibrium between Nitrogen, P_2O_5, and Potassium fertilizers.

Plans by Ministry to Increase Efficiency in the Fertilizer Policy:

1. Planting varieties highly responsive to fertilizer applications.
2. Optimal timing of fertilizer applications to improve effectiveness.
3. Using fertilizers which are appropriate to local soils and crops.
4. The availability of fertilizer to farmers at the appropriate time during the growing season from both local production and imports.
5. Encourage use of P_2O_5 fertilizers in Upper Egypt.
6. Using Potassium fertilizer in horticulture.
7. Extension of storage foundations.
8. Extension of organic fertilizer use.
9. Extension of research and studies to evaluate new fertilizers.

The Main Steps Involved in Chemical Fertilizer Distribution:

A. Reaching Alexandria port to discharge.

   1. Importation through the Agricultural Credit Bank.
   2. Packaging.
   3. Storage.
   4. Transportation.

Problems Involving Loss of Chemical Fertilizers:

1. Importation: congestion and wasting in harbors and inefficient off-loading of ships.
2. Inadequate storage facilities cause losses due to exposure to weather.
3. Transportation inefficiency results in fertilizers not being available when needed during the growing season.

Quotas and Actual Needs for Using Chemical Fertilizers:

In studying the quota system for N and P_2O_5 in comparison to the actual needs of farmers, a misallocation of these fertilizers has been observed. The quotas of fertilizer do not represent the actual needs of some crops. For example, cotton requires 23.5 kg. of P_2O_5 but the quota is for 15 kg., and rice requires 60.5 kg. of N but the quota is 31 kg.

2.A.2. Pesticides

In studying the value of the factors of production from 1965-1979, the pesticide component represented 5.28 percent of the total value or 189 million L.E. In 1978 the pesticide value was 1.061 million L.E. or 3.58 percent of the total factors of production. Pesticides used on cotton in 1965 totaled 9.5 million L.E. which represented 86.3 percent of the total value of pesticides used in agriculture. In 1978 the pesticides used in cotton declined to 9.1 million L.E. or 23.95 percent of the total value (see Table 2-10).

The quantity of pesticides used during 1961-1980 increased slowly at an average rate of 1.5 percent, with the average quantity equal to 22,073,055 tons. A regression of quantity on time produces:

$$\hat{Y} = 20{,}170.495 + 341.339\ X,\ R^2 = 0.07.$$

$\hat{Y}$ = quantity of pesticides used (thousand tons).

X = time (1,...,20).

Costs of Pesticides for Major Field Crops

Cotton: In 1967, the beginning of the period studied, hand control of insects represented 52.77 percent, 9.49 million L.E., of the total value of pesticides. Chemical control represented 47.23 percent in the same year. By

1980, hand control represented 21.21 percent, 14.139 million L.E. and chemical control accounted for 78.79 percent of the total value of pesticides (6.75 million L.E.). The total value of pesticides in 1980 amounted to 37.542 million L.E. compared to 17,983,000 in 1967. The cost of pesticides represented 12.1 percent of the value of variable cost (41.4 L.E.) in 1965 and 9.5 percent of the total (141.8) in 1979 (see Tables 2-11 and 2-12).

Wheat: No Pesticides Used.

Maize: The pesticides used from 1965-1969 represented. The government carried half of the cost of pesticides for variable cost for 1973, 1974 and 1975 amounting to 1.54 percent, 1.2 percent and .7 percent (39, 45.2, 55.4 L.E.), respectively.

Vegetables: The value of pesticides used for eggplant in 1965 represented 1 percent (.4 L.E.) of the variable cost (37.9 L.E.). In 1979, pesticides represented 1.7 percent of 1.8 L.E. of variable cost (104.9 L.E.). The value of pesticides used for potatoes in 1965 and 1979 represented 2 percent and 4.9 percent of variable cost (76, 278.3 L.E.), respectively. The value of pesticides used for marrow represented 3.5 and 3 percent of variable cost (28.7, 96.4 L.E.) for 1965 and 1979. The value of pesticides used in watermelon production in 1965 and 1979 represented 4.5 and 7.9 percent of variable costs (629, 290.4 L.E.), respectively.

Pest Control Policy

The success of any pest control policy is determined by a number of factors. First, a complete pest control plan must aim to protect crops from pests and reduce infestations of pests by adopting the most efficient methods, for example, by utilizing biological enemies and protecting biological enemies from pesticides. Second, the appropriate pesticides must be chosen based on extensive research to judge the impact of the pesticide on productivity as well as its side effects. The MOA should base pest control policy on the recommendations of a committee of scientists and agricultural exports. Third, pesticides and pesticide equipment must be made available at the appropriate time to farmers. Fourth, pest control workers for the MOA must be trained in the appropriate use and distribution of pesticides. Fifth, a pest control policy must be established to protect the country from pests being carried through agricultural imports.

Economics of Pesticide Use On Cotton

Research shows that the loss in yields for cotton are approximately 30 percent on average. Based on this figure, Table 2-14 shows calculations of annual economic losses which would have been incurred if pesticides had not been used from 1965-1979, and the resulting returns to pesticide use net of cost. The calculations show that returns are not always positive and not large when positive. In view of the dangers of pesticide use, and in view of the small positive or negative economic returns to pesticides in cotton production, there is a need for the MOA to re-evaluate policies for pesticide use. Agricultural research may be able to produce more economically viable and less harmful means of pest control. For example, biological control of insects in maize may be possible by choosing the most suitable planting times for pest control.

2.A.3. Seeds

The government carries a cost of approximately 1.2 million L.E. annually to reduce the cost of pure seeds to farmers. The value of seeds in 1965 amounted to 25 million L.E. which represented 13.23 percent of the 189 million

L.E. total value of the factors of production. The value of seeds in 1980 totaled 113 million in 1978, representing 10.65 percent of the total factors of production (1,061 million L.E.) in the agricultural sector.

The value of seeds for rice, wheat, cotton and maize amounted to 3.4, 2.8, 1.0 and 1.1 L.E. or 10.6 percent, 12.11 percent, 2.4 percent and 4.9 percent of the average variable costs per feddan which were 32.2, 23.1, 41.4 and 22.3 L.E. in 1965, respectively. In 1980 the value of seeds was 6.2, 5.4, 2.2 and 1.8 L.E., representing 8.2 percent, 8.2 percent, 2.8 percent and 1.4 percent of average variable costs (81.7, 65.7, 81.3 and 117.5) for these crops, respectively.

The value of seeds for potatoes, watermelons, eggplant and marrow represented 52.8 percent, 4.3 percent, 6.6 percent, 4.7 percent and 4.2 percent of average variable cost, which amounted to 76, 62.9, 32, 36.2 and 28.7 L.E., respectively, in 1965. In 1979, the statistics were 58.1 percent, 7.1 percent, 7.4 percent, 9.9 percent, and 4.6 percent of average variable costs totaling 278.3, 290.4, 149.3, 104.9 and 96.4, respectively.

Seed Production

Seed production is different than other crops in Egypt. The government's policy aim in preparation of foundation and registered seeds is to reduce the cost of certified seed varieties and hybrids to be distributed to farmers. Certified seeds are produced by the government and then distributed by contracts. The government controls the area in which the seeds are grown. They control the fields during planting, various stages of growth and harvest. The fields and seeds are cleaned of foreign material to maintain seed quality. The government also sets the price of seeds to be sold to farmers.

The value of seed use for field crops totaled 9,401,000 L.E. or 74.25 percent of the total 12,662,000 L.E. value of seeds in the agricultural sector in 1970. The value of seeds for vegetables represented 25.75 percent of this total. From 1975 to 1979 the value of seeds used for field crops amounted to 140,084,000 L.E. or 54.13 percent of the 26,021,000 L.E. value of seeds used in agriculture. During this period, vegetable seeds represented 45.87 percent of that total.

2.B. Major Egyptian Crops

This section examines the relative importance of four major crops, rice, cotton, wheat and maize, in agricultural production in Egypt between 1965 and 1979. Since the East Delta region comprises a significant portion of agricultural land in Egypt, specific data from three main governorates in this region are examined.

2.B.1. Rice

In 1965 rice production comprised approximately 6.7 percent of the total value of plant production in Egypt. This share grew slightly during later years. The share of total agricultural production accounted for by rice is even smaller, roughly 4.9 percent, which remained relatively constant from 1965 to 1979.

The share of total cultivatable land that rice comprises fell from 11.6 percent in 1965 to 9.3 percent in 1979 (Table 2-15). Examination of rice exports for this period reveals that exports declined 1969-79. This may be explained by the government policy which ws modified to encourage increased domestic consumption of rice at the expense of exports (Table 2-16).

Changes in Area Cultivated, Yield, and Production

Rice in Egypt is grown in two seasons; summer and Nile. Analysis of Table 2-17 through 2-20 shows that while total area cultivated in rice between 1965 and 1979 increased at an average annual rate of 0.7 percent, yearly growth in the East Delta region was somewhat higher. Growth in rice area in the East Delta governorates of Sharkia, Dakahlia, and Domiatte during this period was 0.4 percent, 0.5 percent, and 0.3 percent annually. Land cultivated in rice in the Sharkia and Dakahlia governorates represent significant proportions of total rice area in Egypt, (16.3 percent and 26.7 percent) while rice area in the Domiatte governorate represents a smaller share of total rice area (4.8 percent).

Yield per feddan of summer rice increased in these three governorates at about the same rate as the average national increase of 6.7 percent over the period. Total production of summer rice also increased by approximately 7 percent during the same period. Production growth in the three governorates exceeded the national average. Production of rice in the Sharkia and Dakahlia governorates represent significant proportions of total rice production in Egypt (15.8 percent and 26.5 percent), while the Domiatte governorate contributes only 5.1 percent of total Egyptian rice production.

Production Costs Per Feddan

Between 1965 and 1979 the average cost per feddan of rice in Egypt increased by 211.7 percent. During this same period the estimated cost increases for the governorates of Sharika and Dakahlia exceeded this national average, while the increase for the Domiatte governorate was slightly less than the national average. One of the largest costs contributing to this increase was the labor factor, which increased from 41 percent to 47.3 percent of total variable costs during the period (Tables 2-25 to 2-28). The average net return from rice per feddan roughly doubled from 1970 to 1979. Increases in return in the three governorates were even greater during the same period (Tables 2-21 to 2-24).

Production Policy

Factors that influence rice production in Egypt may be divided into two main categories: irrigation and nonirrigation related. The major nonirrigation related factors are soil quality, farming methods, and seed and fertilizer quality. The Ministry of Irrigation (an agency of the MOA) has exclusive jurisdiction over area cultivated in rice. In accordance with Egyptian Law No. 31 (1961) the Ministry determines the regions and the time schedules for cultivation of rice. The time schedule is as follows:

Region	Schedule
1	June 1
2 & 3	June 8
4 & 5	June 16
Rice Nursery	April 16

Total area cultivated in rice in 1965 was approximately 1.191 million feddan compared to 1.04 million feddan in 1979. In accordance with the requirements of the world rice market, the MOA created new varieties of rice which replaced the Nahda. Subsequently, in 1978 over 90 percent of the total rice area cultivated consisted of the new varieties of rice. In 1979 legislation was passed which prevents farmers from buying fertilizer at subsidized prices unless they comply with the policy of mandatory sale of 25 percent of their rice crop to the government.

Pricing Policy

Pricing of other crops has a direct effect on the amount of area cultivated in rice. Other influential factors include producers' net income levels, total crop production, and imports and exports. Rice pricing policy is therefore intertwined with economic and social policy goals of other countries.

The rice pricing policy is primarily conducted through the cooperative marketing system. Rice prices are determined according to the cost of production and are set to generate a high enough return to meet the rental value of land. When rice by-products are involved, revenues are substracted from the total estimated value of the physical plant product.

Prices of rice for export are determined by a weekly base system by a committee comprised of the following companies: The Nile Agricultural Crop Exporting Company, the Wady Company, the Nassar Export and Import Co., and the Egyptian Foreign Trade Company. Prices are different for certain foreign markets such as Russia, West Germany, and Libya. Trade with other European countries and with Saudi Arabia is conducted through organized exchanges and auctions.

A major problem in the analysis of Egyptian rice exports is in the estimation of production and cultivated area data. Other difficulties include problems in transportation from production centers to central marketing areas, as well as inadequate storage facilities at ports. Finally, the structural inconsistency between production, marketing, and export systems create problems for an analysis of rice exports.

Cooperative and Marketing Policy

In 1978 an attempt was made to return the control of marketing cooperatives to cooperative members. In addition, the General Cooperative of Rice Producers (Central and Common Cooperatives) continued marketing rice in Behira, Kafer El Sheikh, Gharbia, and Sharkia governorates. Production in these governorates comprises approximately 60 percent of total rice marketed in Egypt.

The General Cooperative of Rice Producers from Behira, Kafer El Sheikh, Gharbia, and Sharkia governorates is the primary rice marketing entity in Egypt. Prices are derived from the cost of production-related factors stated above. Also, L.E. 12 per ton carrying charges are substracted from the farmers revenue from the sale, as are marketing charges. There is a three day lag between the sale and the time payment is received by the farmer.

Rice prices in Egypt increased from L.E. 32 per ton in 1974 to L.E. 50 per ton in 1976, while the estimated increase in costs per feddan increased from approximately L.E. 42 to L.E. 130 or 211.7 percent between 1965 and 1979. In 1979 the Ministry of Supply increased the prices of brown rice, according to variety, as follows: L.E. 66 for Japanese, L.E. 62.4 for Nabahtat, 58.5 for Sabaheeny, 71.5 for Philippine, 73.15 for Arabic.

2.B.2. Cotton

Cotton is a crop of major importance to Egyptian agriculture, primarily due to its significance to overall agriculture production and agricultural income. This study examines the relative importance of the value of cotton production during the 1965-1978 period. The value of cotton production increased by 42.5 percent in nominal terms from 1965 to 1978. In contrast, cotton's share of total plant production decreased from 26.5 percent to

11.2 percent over the same period. This change is reflected in the cropping pattern shift from cotton to more profitable crops. Cotton's share of total agricultural production also dropped (from 19.5 percent to 8.3 percent) during the same period, and the share of cotton exports decreased from 55.6 percent to 20.8 percent of total exports (Table 2-33). This was primarily a result of the reduction in area cultivated, decreasing cotton prices, increasing production costs, and changes in export policy (Table 2-29).

The change in area cultivated in cotton in the three governorates paralleled the same change nationwide, in which cotton's total cultivated area decreased by roughly 38 percent, or at an average annual rate of 21 percent (Tables 2-29 and 2-34). The East Delta region accounted for approximately 11 percent of the total area cultivated in cotton, while the Sharkia governorate accounted for 41 percent of the East Delta 1 and cultivated in cotton. At the same time, the cotton area cultivated in the Dakahlia governorate comprised 15 percent of the total and 54 percent of the East Delta area. The area cultivated in cotton in the Domiatte governorate represented 1.3 percent of the total and 4.6 percent of the East Delta cotton area for the same period. Growth in yield per feddan in the three governorates exceeded the national average yearly increase of 11 percent (see Table 2-35). The total production of cotton decreased over the period by 9.8 percent per year over all Egypt.

Production costs during the period increased on average by 190 percent. Again, labor which was the most expensive variable cost share, increased from 50.2 percent to 58.2 percent of total production costs. The cost share of animal power decreased over the same period from 13 percent to 5.4 percent. This change illustrates the increased use of mechanical power in Egypt. With the exception of the Dakahlia governorate which experienced a smaller increase (140 percent), cost increases in the three governorates roughly equalled the national average increase (Tables 2-37 to 2-41).

Production Policy

The objective of Egyptian cotton policy is to achieve maximum production per feddan of land. The policy may be described as follows:

1. Government intervention in the planting and marketing of cotton. This is executed by the following methods:
   a. Determining the size of acreage planted in cotton; determining which varieties are grown in each region; setting production goals for supplies to local and export markets; regulating cotton quality; and determining the acreage allotments for other crops.
   b. Providing insurance to farmers against diseases.
   c. Providing financial assistancce to farmers through Credit Banks and subsidies.
   d. Exempting cotton producers from taxes on cotton gin for a specified period of time.
2. Encouraging research and development in cotton yields through:
   a. experiments on the chemical "Drob" to increase yields.
   b. experiments on bacteria species for the eradication of the cotton leaf worm.
3. Specifying regions for cotton growing according to cotton variety. For example, in 1980 varieties were designated to the following regions:

Variety	Region
Giza 70	Dakahlia Governorate
Giza 68	Shebin and Domiatte Governorates
Giza 69	Sharkia Governorate (excluding the districts of Deyarb Negm, and Kafer Saker)
Giza 67	Kafer Saker and Deyarb Negm districts
Giza 75	Dakahlia Governorate (excluding Balkas and Sherban districts)

4. Cotton Seed Production Policy

Government policy also determines the location of production of cotton seed varieties. Through this program, the government controls the area and treatment of seeds.

5. Pest Control Policy

In an effort to encourage cotton production, the government shares half of the financial burden of pest control with cotton farmers. Insecticides for use in cotton production comprise roughly 70-75 percent of the total value of pesticides. The Government encourages the use of insecticides, while at the same time discourages the use of chemical pesticides.

6. Fertilizer Policy

The MOA administers allotments of fertilizer for use in cotton production on the basis of <u>land</u> area. For example, in 1981 the quota for Super Phosphate was 100 kg per <u>feddan</u> for East Delta governorates.

Marketing Policy

Cotton marketing is handled in a variety of ways. The two main marketing methods are described below:

1. The Free Market

Cotton contracts in Alexandria play a major role in determining the free market price of cotton. The free market system is faced with several problems, however, the most important of which is instability in prices, which may benefit retailers at the farmers' expense.

2. The Cooperative Market

Marketing cooperatives, which began in 1908 were set up to benefit the farmer through a more stable pricing system.

Problems in Marketing

The major problems in cotton marketing in Egypt are as follows:

1. Instability around cotton buyers and sellers.
2. Difficulties in farmer's ability to follow those changes between seasons.
3. Cooperative weaknesses.
4. Marketing through cooperatives with the absence of competition from the private sector resulted in a near-monopoly situation.
5. Lack of benefits from cotton sales for the middleman who is excluded from the cooperative marketing system.

Price Policy

Examination of production costs per Kantar in the East Delta region between 1965 and 1979 (with 1965 as the base year) showed an increase of 150 percent across all governorates. Prices during the same period increased by roughly 300 percent. This difference is attributed to government policy which raised the price of cotton in order to encourage production (Table 2-41).

2.B.3. Wheat

Wheat is considered to be a main crop for human and animal consumption in Egypt. Land cultivated in wheat comprised roughly 11 percent of total cultivated land in 1965 and increased to 12.4 percent in 1979. The value of wheat production, however, decreased from 9.7 to 9.3 percent of total plant production during the same period. Similarly, wheat production as a share of total agricultural production declined from 7.2 percent to 6.9 percent during the period. In addition, the value of imports of wheat increased absolutely but declined as a share of total imports during this period (from 15.2 percent to 7.4 percent of total imports).

Area cultivated in wheat increased yearly during the period at an average rate of 0.6 percent. While the cultivated wheat area figures for the Sharkia governorate followed the national average, the area cultivated in wheat for the Dakahlia and Domiatte governorates actually decreased (by .01 percent and 1.8 percent, respectively). According to the data the Sharkia, Dakahlia, and Domiatte governorates represent 11.7 percent, 11.1 percent, and 1.1 percent of total wheat area cultivated. These same governorates comprise 44.7 percent, 42.4 percent and 4.9 percent of the East Delta area that is cultivated in rice. Yield per feddan and total production increased both nationwide and in the three East Delta governorates during the period (see Tables 2-42 through 2-45).

As expected, the costs per feddan of wheat production increased on the national and East Delta levels. Labor again surfaces as the fastest increasing variable costs during the period. At the same time, net return per feddan increased by roughly 9.6 percent nationwide. The breakdown of production cost increases for 1965-1979 is as follows: all Egypt:

161.9 percent; Sharkia, 208.9 percent; Dakahlia, 176.2 percent; and Domiatte, 140.4 percent.

Net return per feddan increased from an average L.E. 19.5 to L.E. 38.3 between 1965 and 1979 in Egypt. The return in the Sharkia governorate increased from L.E. 26 to 56, the increase in the Dakahlia governorate return was L.E. 17.65 to L.E. 64.68 and the Domiatte governorate average increase went from L.E. 18.88 to 47.54 (Tables 2-46 through 2-49).

Production Policy

Certain varieties of wheat produce yields of more than 30-35 percent over present yields. Yield per ardab increased by 25 percent between 1970 and 1975. The increase may be largely attributed to better quality seeds and increased use of insecticides. Ministry of Agriculture activity in hybriding has served to strengthen the relationship between farmers and government. Farmers generally follow the MOA information and advice on the use of new seed varieties and cultivating methods. The Mexican variety has been adopted due to its high productivity. The MOA recently introduced the following new varieties: Giza 157, Giza 158, and Sakha 8. These varieties are characterized by high productivity and their high responsiveness to fertilizers. In 1979 the MOA made available enough Shenab 70 seeds for 100,000 feddan. This was in addition to the new varities made available which were enough to plant 110,000 feddan of wheat.

The MOA objectives in targeting production planning of seeds in the future for 1.3 million feddan are as follows:

1. Make available 50 percent of the new variety seeds for planting (Giza 157, Sakha 8, Sakha 61, 62, 69 and Giza 155).

2. To increase production of the El-Durm variety for use in the manufacture of flour for macaroni.

The relative importance of inputs at the level of Egypt and for Sharkia, Dakahlia and Domiatte governorates is shown in Tables 2-50 to 2-53.

Price Policy

Prices play a central role in the economics of production and consumption in Egypt. Since the total area cultivated in wheat is only 1.3 million feddan, MOA officials have attempted to encourage expanded production. The 1.3 million feddan has only produced an average of 1.2 million tons annually which is insufficient to meet the amount demanded for domestic consumption. This has made Egypt dependent upon wheat imports. The government has tried to reduce this dependency by increasing wheat prices (prices were raised from L.E. 9.6 per ardab in 1979 to 11.5 per ardab for most varieties in 1980).

Marketing Policy

The following is a description of the 1979 MOA law that governs the delivery of wheat to the Ministry of Supply and the Generalized Agency for Supply:

1. Delivery of wheat for the current season without maximum limits placed on the amount of production of any variety.
2. The Ministry of Supply sets controls on the amount cultivated between May 1 and July 31.
3. The system of delivery of wheat is as follows:
    a. MOS estimates the size of the area cultivated in wheat.
    b. A committee comprised of representatives from the agency, co-ops and farmers determines the amount needed for cultivation to meet domestic needs.

c. The information is then distributed to District Tax Offices, Agricultural Credit Banks, and the Cooperatives, which in turn make it available to farmers.

Before the emergence of marketing cooperatives in Egypt, the marketing of wheat was handled on the local level. Farmers sold their wheat to retailers in the local area and to wholesalers in Cairo. Prices and quantities supplied on the local levels were primarily determined by retailers while prices and supply at the wholesale level were reached only after seller-buyer negotiation.

After World War II as a result of government controls on amounts planted, domestic production of wheat declined by roughly 1.3 ardabs per feddan. Under the government program, pre-determined prices (300-350 p. per ardab) were set, and payment was handled through the Agricultural Financial Bank (AFB). Producers were responsible for transportation charges from the farm to the <u>Shoha</u>. These costs are roughly 1 piaster per km. per ardab, with a maximum charge of 10 piasters per ardab. On occasion producers may sell surplus wheat to the AFB for roughly 50 piasters/ardab over the regular price. In 1954 the program was changed to allow producer sales to retailers from October 1 to the end of the year.

After the birth of the General Egyptian Institute of Mills (GEIM), the General Egyptian Institute of Agricultural Credit was charged with the responsibility for wheat planting control policy. At that time, the government procurred approximately 13 ardab per feddan during the 1975-1976 marketing season, at a price of L.E. 8 per ardab. In addition, the Agricultural Credit Institute has thus been responsible for wheat procurements, storage, and the sale of surplus wheat.

2.B.4. Maize

In addition to its widespread use as summer fodder and poultry feed, maize is an important crop for human consumption in Egypt's rural sector. The share of total area cultivated in maize increased from 14 percent in 1965 to 17 percent in 1979. In 1965 maize production comprised roughly 10.6 percent of the total value of plant production and 7.8 percent of the total value of agricultural production. These figures fell to 10.3 and 7.6 percent in 1978. Imports during the 1965-1979 period fluctated somewhat from the 1965 level of L.E. 4.178 million.

Area cultivated in maize increased at a yearly rate of 2.5 percent during the 1965 to 1979 period. Two of the three governorates of interest exhibited smaller rates of increase (1.5 percent for Sharkia and 1.2 percent for Dakahlia), while the other, Domiatte showed a yearly decrease of 1.4 percent in land cultivated in maize.

Total production and yield per feddan both increased during the period. Again, the Domiatte governorate was the only governorate of the three to exhibit a decrease in production. Specifically production increased over all Egypt by 2.8 percent and over the Sharkia and Dakahlia governorates by 2.5 percent and 2 percent, while the Domiattee governorate showed a decrease of about 0.6 percent yearly. The study also showed the following shares of maize production by governorates: Sharkhia: 14.1 percent of total, 73.3 percent of East Delta; Dakahlia: 4.8 percent of total, 24.8 percent of East Delta; and Domiatte: 0.4 percent of total and 1.9 percent of East Delta. The East Delta region comprised roughly 19.3 percent of total Egyptian production of maize (Tables 2-54 to 2-57).

Costs per feddan of maize increased by 210 percent during this period. The highest cost share increase was in labor, which jumped from 36.3 to 44.9 percent of total variable costs in production (Table 2-58). Net return per feddan increased by 195 percent between 1970 and 1978 in nominal terms, from an average of 20 L.E. to 39 L.E. (Table 2-59).

Production Policy

In 1965 in an effort to increase supplies, maize was changed from Nile to summer plantings. Despite this move, Egypt continues to depend on approximately 100,000 tons of annual maize imports to meet domestic demand.

The main factors which influence production are as follows:

1. The inbred line used in agriculture
2. Time of planting
3. Previous period crops
4. Time of irrigation
5. Weather
6. Mechanization
7. Drainage
8. Fertililzer
9. Insecticides

The Ministry of Agriculture has been successful in recent years in their encouragement of maize varieties with increased disease resistance. Ministry of Agriculture officials have encouraged production of double hybrids such as 404, 405 as well as synthetic varieties such as Giza 1, 108, 4, 6, and seeds 1 and 2. The MOA objective has been to replace varieties that are currently distributed with these new hybrids, ultimately capturing 10-12 percent of total cultivated area in maize.

In an effort to achieve self sufficiency the MOA position has centered around the following recommendations:

1. Concentration on important hybrids and expanded planting.
2. Expansion in the cultivation of summer maize.
3. Agricultural Extension assistance for maize.
4. Increased use of appropriate fertilizers.
5. Increasing yield per feddan.
6. Forbidding the cultivation of maize after May 31 of each year in certain districts.

Price Policy

Following World War II the pricing of maize was changed to a method which determines prices on the basis of ardabs (140 kg.) and the degree of cleanliness, measured in Karate. Prices are based on costs of production and set jointly by the Ministries of Agriculture and Supply. Pricing policy for maize in Egypt does not consider local production, imports, consumption, or prices of other crops. This fact, combined with the rise in black market activity during shortages, has undermined efforts to benefit consumers through low prices for maize. Examination of changes in costs versus changes in prices for maize since 1965 showed that the rate of increase in costs has exceeded the rate of increase in price. Thus, it would appear that pricing policy must be modified in order to provide incentive to farmers to produce maize.

Part III

Agricultural Policy and Agricultural Productivity in Egypt: A Preliminary Theoretical and Empirical Analysis

A major objective of Egyptian agricultural policy has been and continues to be to achieve the agricultural productivity growth necessary to meet or exceed the needs of Egypt's growing population and to provide foreign exchange for industrial and agricultural imports (Goueli 1981). However, it is clear from Part II of this report that the Egyptian agricultural sector is not meeting this productivity goal, and productivity has stagnated and in some crops actually declined during the past decade. Therefore, a major task facing Egyptian policy makers is to resolve this productivity problem. In this part we aim, first, to outline the major factors which we believe contribute to the productivity problem. To this end we evaluate two dimensions of agricultural policies: (i) policies affecting the efficiency of resource use from major crops at the farm level; (ii) policies affecting the rate and type of technical change in Egyptian agriculture overall. Second, we present preliminary statistical analysis of micro and macro production data and draw some preliminary conclusions about the determinants of production efficiency in the major Egyptian crops of rice, wheat, maize, and cotton.

The major conclusions of Part III of our report are as follows:

1. As economic theory suggests, the major economic effect of Egyptian agricultural policies--price policies, input supplies, and acreage and quota policies--is to induce a state of "semi-traditional agriculture," which is characterized by technologically static equilibrium which exhibits some features of both traditional agriculture and of more modern production technology. This static

technological equilibrium is due to both agricultural policies which tax farmers and inhibit farm level technical change, and institutional failure to develop and diffuse effective new technology. This static technological equilibrium is also characterized by policy-induced economic inefficiency at the farm level which is due to conflicting quantity and price regulations. Thus, the government's price policies appear to have both short-run effects of inducing inefficient farm-level resource use, and the potentially more serious long-run effects of discouraging technical change and the accumulation of both the human and nonhuman capital essential to long-run technical change that serves as a basis for productivity growth.

2. Since productivity growth in the long-run depends on technical change in the agricultural sector, the government's policy towards agricultural research, extension, and input supply are critically important to the resolution of the productivity problem. The preliminary evidence reported here suggests that there has not been the substantial technical change in Egyptian agriculture needed to generate long-run productivity growth. Moreover, the data suggests that price policies have <u>discouraged</u> production in precisely those crops which have experienced some productivity growth, and have <u>encouraged</u> those crops with the least productivity growth. Thus, rather than promoting productivity growth, Egypt's agricultural price policies have had quite the opposite effect.

3. The empirical analysis of farm level data suggests that Egyptian farmers are very responsive to price changes in making their input

demand and output supply decisions. Thus, Egyptian farmers do appear to be economically rational. Profit and cost function estimates of input demand elasticities and elasticities of substitution between inputs show substantial technical substitution possibilities between animal power, mechanical power, and human labor. As a result of these technical substitution possibilities, there are substantial demand cross-elasticities. While these input demand elasticities vary from crop to crop, there is a consistent pattern across crops of complementarity between family labor, mechanical power, and animal power, and substitution between family labor and hired labor. The price elasticity of demand for mechanical power is found to be between 0 and -1.5 and for nitrogen fertilizer it is found to be between -.5 and -1.5. It is interesting to note that estimates of the elasticity of substitution suggest that the agricultural technologies of these major crops are not of the Cobb-Douglas form.

4. The data show clearly that farmers are not allocating fertilizer according to the MOA rules. As Figures 3-3 to 3-6 show, a substantial number of farmers use much more or much less fertilizer than the MOA quota. Under the existing price and quota system this behavior may be rational from the farmer's point of view because fertilizer demand varies according to local production conditions and prices. For example, when economic returns to fertilizer use on other crops such as vegetables are high, farmers will rationally sell fertilizer allocated to them for rice, wheat, maize, or cotton, or use fertilizer on their own vegetable crops. The implication for the relationship between ag. policy and productivity is that the

government policies reduce productivity by forcing farmers to use suboptimal resource allocations.

5. The implications of these empirical findings for the management of the crop rotation system in Egyptian agriculture are also strong and clear. By discouraging more production of the major Egyptian crops, and by discouraging specialization in these crops, it is clear that the price policies and the conflicting crop rotations system and quota policies have the net effect of discouraging specialization in production; this fact is abundantly clear from the evidence on fertilizer use. Since the policies discourage the application of fertilizer to the major crops such as cotton and rice, and encourage farmers to allocate fertilizer to other secondary crops such as vegetables, these policies are not encouraging farmers to increase efficiency through specialization. Thus, rather than having the effect of encouraging specialization and encouraging increased productivity through the managed crop rotation system, Egyptian agricultural policy appears to have a negative effect on overall productivity of Egyptian agriculture through despecialization of production.

3.A Economic Analysis of the Productivity Problem

3.A.1 Theoretical Foundations: A Schultzian Model of Semi-Traditional Agriculture

In this section we briefly outline some theoretical concepts for analysis for the agricultural productivity problem in Egypt. We begin by describing a version of Schultz's (1964) framework which has received strong support from agricultural research around the world during the past two decades. Then we describe the two components of economic efficiency, allocative and technical efficiency.

Schultz's model of agricultural development is based on the premise that farmers in "traditional agriculture"--that is, in agriculture characterized by static technological equilibrium such as Egypt experienced for thousands of years--farmers are "poor but efficient." They are efficient because they know from accumulated experience how best to use the resources at their disposal. They are poor not because they use their resources inefficiently, or because they are economically irrational in their resource use, but rather because their "traditional" resources and production techniques yield a low return. Therefore, the only solution to the productivity problem of farmers in traditional agriculture is the introduction of new, more productive resources and production techniques which raise agricultural productivity. This process of technical change requires three complimentary components:

1. Agricultural research to provide the scientific developments, such as the creation of high yielding varieties, which are the basis for productivity increases.
2. Adequate infrastructure to facilitate the transfer of information about new technology, and to provide market access for farmers to sell products and purchase nontraditional inputs. Infrastructure includes adequate transportation and communication facilities to facilitate the development of both input and product markets which provide economic incentives for farmers to invest in the human and nonhuman capital associated with the new technologies (Antle 1981).
3. Investment in human capital so that farmers are able to successfully learn about and use the new technologies.

Another key element of the Schultz's model is the hypothesis that farmers are economically rational in their farm decision making and generally attempt to maximize the economic returns to their production activities. This hypothesis is of the utmost importance to the analysis economic efficiency, and has been supported by numerous studies of farmer behavior in both developing and developed agricultures (Schultz 1975). Therefore, we can expect Egyptian farmers' to make economic decisions rationally, subject to the economic, institutional, and social constraints they face. The important implication of farmers' economic rationality is that the sources of economic inefficiency must lie in the constraints farmers face and not in their irrational or uneconomic behavior.

There are two dimensions of economic efficiency to be considered: allocative efficiency and technical efficiency. Allocative efficiency is defined as the equality of marginal benefit to the marginal cost of each resource used. Research has shown that farmers in static traditional agriculture are allocatively efficient, but in an economically dynamic environment they may differ in their degree of allocative efficiency due to differences in their ability to acquire and use economic information (Schultz 1964, 1975; Herdt and Mandac 1981). Technical efficiency is defined as the production of the maximum output possible with a given set of inputs and a given production technique. To understand technical efficiency in the context of agricultural development, it is important to distinguish between relative and absolute technical efficiency. Absolute efficiency refers to efficiency under "ideal" conditions of prefect technical knowledge and optimal physical conditions. Relative efficiency is defined in terms of farmers' human capital, physical resources, and economic constraints. Schultz's hypothesis of farmer rationality suggests that farmers are technically efficient relative to their own economic and technological constraints, but because of these constraints they may be inefficient in absolute terms.

In conclusion, Schultz's model of agricultural development suggests that production inefficiencies are not generally due to farmer irrationality. Therefore, inefficiency at the farm level may be due to (1) government policies which prevent farmers from maximizing the economic returns to their resources, and (2) other social, political, or economic factors which constrain the farmer's ability to acquire and efficiently use new production technology. We shall show in the remainder of this chapter that Egypt's agricultural sector is neither "traditional" nor "modern," as it exhibits characteristics of both technologies. As we shall show in section 3.C, for the past 15 years Egypt's agricultural technology has not changed rapidly although some characteristics of modern technologies, such as some mechanization, have been introduced. Thus, we may characterize Egypt's typical farmer as practicing "semi-traditional" agriculture: he is currently in a relatively static technological equilibrium with some elements of both traditional and modern technologies. This condition is characterized by relative technical efficiency because farmers have learned to use these techniques as efficiently as possible under their local economic and technological constraints.

3.A.2 Economic Analysis of Egyptian Agricultural Policy at the Farm Level

A major component of Egyptian agricultural policy is the regulation of production through intervention in product and input markets and the enforcement of a governmental crop rotation. These policies are intended to manage agricultural production so as to be consistent with national policy objectives and to "rationalize" production and increase productive efficiency (Ikram 1980). We shall consider here the economic effects of output policies, input policies, and acreage allocation policies on agricultural productivity.

Output Policies

At the farm level, output price policies can generally be expected to alter the economically efficient amount of each crop produced and the allocation of inputs to each crop. Consider, for example, the farmer who grows cotton and vegetables. The farmer's production possibilities frontier in Figure 1 shows all possible combinations of cotton and vegetables that can be produced with a given set of resources. At each output price ratio such as $(P_v/P_c)_1$ a profit maximizing combination of output occurs where $(P_v/P_c)_1$ equals the marginal rate of transformation between C and V, or where $(P_v/P_c)_1$ equals the absolute slope of the transformation curve. Therefore, if the government taxes cotton production by forcing farmers to sell cotton at a lower price, the relative price of vegetables is raised to $(P_v/P_c)_2$, and the farmers optimal crop mix will contain less cotton and more vegetables as at point 2 in Figure 1.

Such a price policy by itself will not induce farm level inefficiency, although it will cause aggregate allocative inefficiency. However, if this price policy is combined with a production quota then farmers may be forced to produce an economically inefficient crop mix. This would occur, for example, if in Figure 1 the government set prices at $(P_v/P_c)_2$ while requiring a cotton quota C_1. Then the farmer would be forced to produce at (V_1, C_1) where the relative product price exceeds the marginal rate of transformation.

If farmers are economically rational, therefore, government intervention in product markets through price and quota policies will force farmers to use resources in a manner which is economically inefficient from the farmers point of view. Farmers, therefore, have an economic incentive to deviate from the government's crop quota for the taxed crop. It should be noted that these output policies also affect input use; a policy induced increase in (P_v/P_c) increases the demand for fertilizer for use on vegetables and decreases the demand for fertilizer for use in cotton. We shall consider the effects of these policies on input demand in greater detail below.

Input Policies

While "traditional" inputs such as labor, manure, and animal power are not regulated, the production, distribution, and pricing of seeds, fertilizer, pesticides, and mechanical power are largely controlled by the Ministry of Agriculture, as described in Part II above. To examine the effects of these policies let us consider the important case of fertilizer. The government monopolizes the distribution of fertilizers through the village cooperatives. Each farmer is allocated a policy-determined quantity of fertilizer per feddan for each crop at a fixed price. If this price is w_g in Figure 2, and the quantity is f_g, then the "official" supply function to the farmer is S_g. If the farmer views w_g as the opportunity cost of fertilizer, and his demand is d_1, then he has an excess demand for fertilizer at price w_g, and if the farmer's demand is d_2 he has an excess supply at price w_g.

Although the official price of fertilizer is w_g, there is a "black market" for fertilizers in Egypt at a price above w_g, say w_m in Figure 2. If the farmer views w_m as the opportunity cost of using fertilizer, then he has an excess demand if his demand curve is d_3 but an excess supply if it is d_1. In terms of allocative efficiency, therefore, farmers would generally be inefficient if they did use quantity f_g at the official price w_g unless their demand happened to be exactly f_g. Generally, some farmers will want less and some will want more than f_g, so that economically rational farmers would tend to trade fertilizer in the black market.

If we return to the output price policies discussed above, we may recall that when a government reduces the price of one crop such as cotton relative to other crops such as vegetables, the demand for inputs for vegetable production increases and the demand for inputs for cotton production decreases. Therefore, this type of output price policy combined with a fertilizer quota would increase the number of farmers with an excess supply of fertilizer for cotton and an excess demand for fertilizer for use on vegetables. Hence, economically rational farmers would either (1) use some of the fertilizer allocated for cotton on their vegetables, or (2) trade fertilizer in the black market.

In conclusion, we emphasize that farmers generally will have an economic incentive to deviate from the government's official fertilizer quota. An economically rational farmer who maximizes economic returns to his resources will not generally produce with the official quota of fertilizer if the quota differs significantly from what the farmer views as his economically optimal resource allocation.

Governmental Crop Rotation

The government's enforced crop rotation system is designed to increase production efficiency by reducing the effects of land fragmentation and to ensure that each year farmers will meet the government's desired production of each crop. Essentially, the crop rotation requires farmers to allocate specific acreages to particular crops at specified times during the year. As an input policy, therefore, the effects on efficiency are not qualitatively

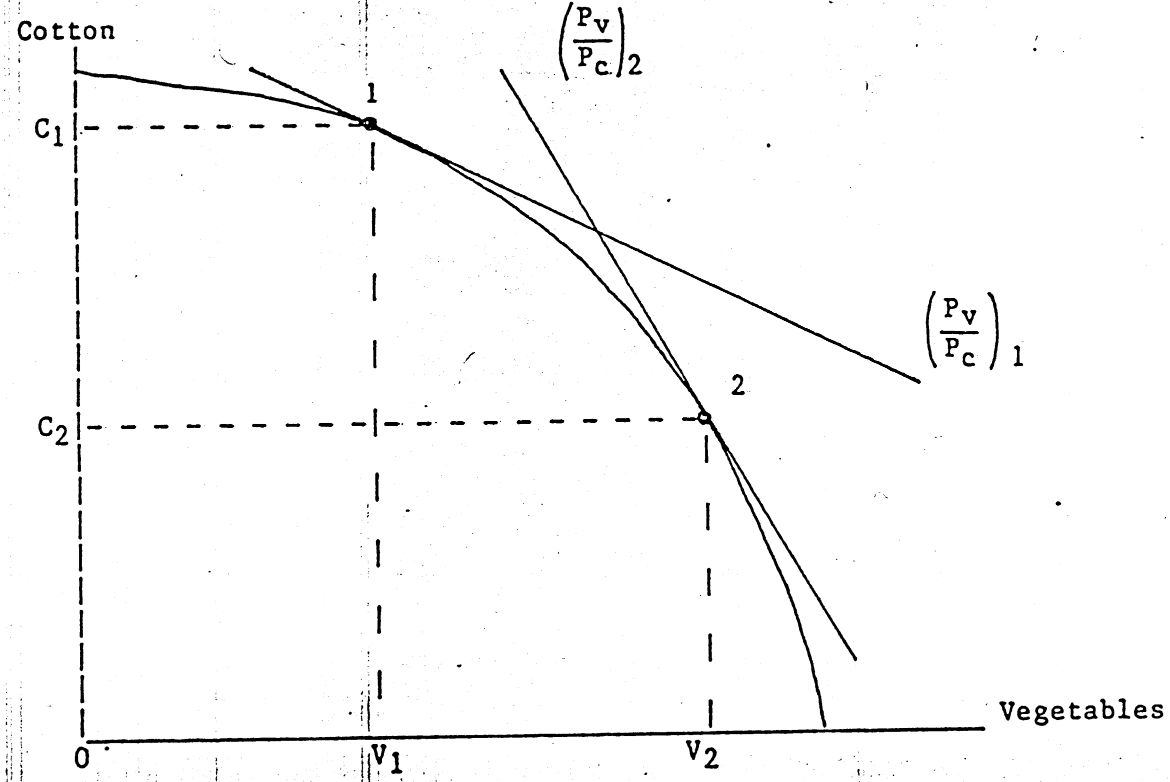

Figure 1: Effect of Output Price Policy on Optimal Crop Mix

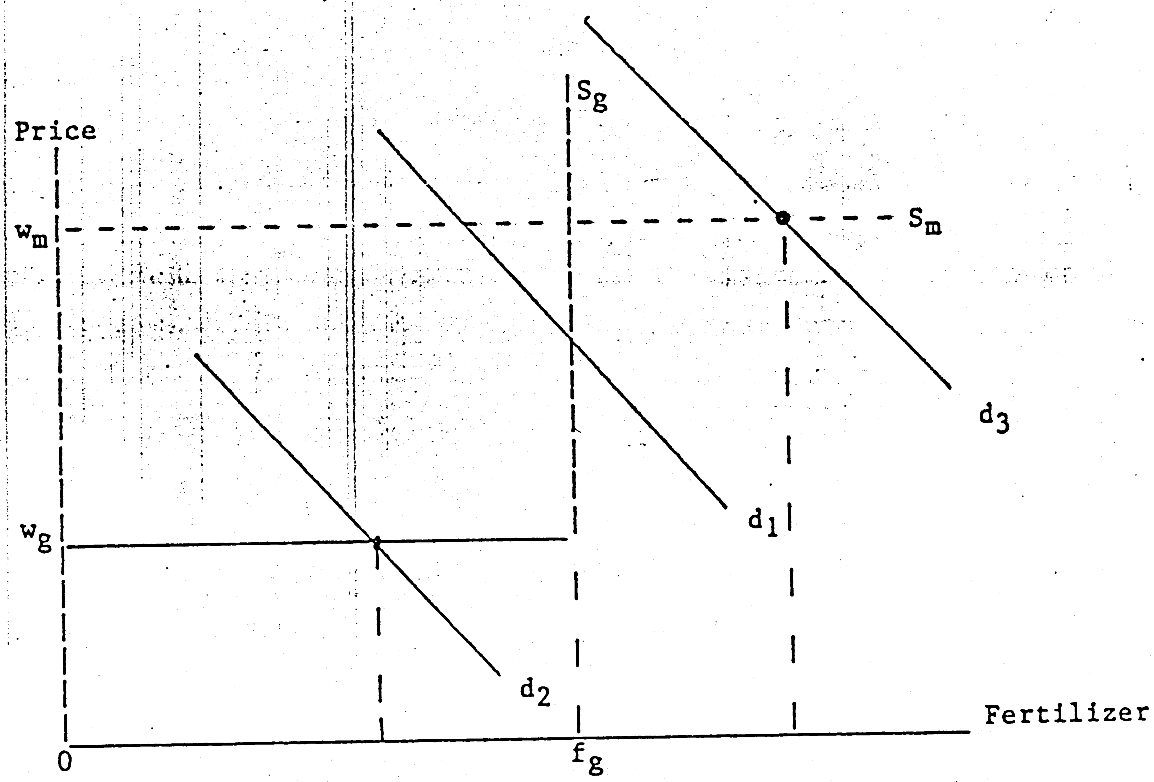

Figure 2: Demand and Supply of Fertilizer

different from those of fertilizer policies; when the enforced rotation and acreage requirements differ from the farmers' economically optimal crop mix and acreage allocations, farmers have an economic incentive to deviate from the government rotation. It is abundantly clear from the data presented in Part II, for example, that farmers do deviate from the governmental rotation, as shown by the case of cotton. Cotton acreage has declined continuously over the past 15 years, despite the government's attempts to maintain or increase cotton acreage.

3.B Empirical Analysis of the East Delta Farm Management Survey Data

In this section cost function and profit function estimates are presented for major crops of the East Delta region. The farm level production data were obtained from the Farm Management Survey project. Summary statistics (means and standard deviations) for the data are presented in Table 3-1 and correlations for one crop (cotton) are presented in Table 3-2.

Our aim is to gain information about the structure of farm level production techniques for major crops in Egypt. In particular, to understand the effects of agricultural policies on productivity we need to know the essential characteristics of agricultural technologies, and we need to know how farmers respond to economic and technical changes that are the result of agricultural policy. We shall attempt to obtain this information by estimating cost and profit functions. Each approach requires different assumptions about the farmers behavior and the structure of this technology and each provides different information. By pursuing several avenues of inquiry, we can cross-check for consistency and obtain a broader view of the relevant relationships.

A major goal of this analysis is to determine the extent to which inputs are substitutable in the production process, and the degree to which input use responds to input and output price changes. Production function estimates can provide information about input substitution, but as we shall see, the profit and cost function approach proves to be more useful for obtaining information about both technical and economic relationships.

3.B.1 Alternative Approaches to Econometric Production Models

In this section we briefly discuss the conventional production function approach to the analysis of agricultural production, and compare it to the approach we shall use below, namely the estimation of the profit and cost functions. This discussion will indicate why the cost function or profit function approach is more fruitful than the production function approach.

The single equation approach to direct production function estimation is based on the assumption that the farmer's technology is

$$Q = f(X, \beta, \varepsilon) \tag{3.B.1.1}$$

where X is an input vector, β is a parameter vector, and ε is a random variable. The single equation approach can be justified by the assumption that the farmers choose inputs X so as to maximize the mathematical expectation of some function, say U (.), of economic returns π. That is, farmers

$$\max_{X} EU(\pi) \tag{3.B.1.2}$$

The solution to this problem gives input demand functions which are nonstochastic and hence independent of ε and Q. Therefore, it is valid to regress Q on X to estimate β using an appropriate single-equation estimation technique; a simultaneous equation estimator is not required. This approach was first suggested by Zellner et al. (1966) in the context of the Cobb-Douglas production function.

While the single equation approach is attractive because it is easy to implement, the assumption that farmers choose inputs as part of a single period decision problem is generally invalid in agricultural production. Indeed, agricultural production processes are typically sequential and, therefore, inputs are likely to be stochastically related to output as is shown in a paper by Antle (1982). Therefore, single equation estimates are likely to be subject to simultaneous equation bias.

An alternative to the direct estimation of the production function is estimation of the dual cost or profit function corresponding to the production function. This dual approach has two main advantages over direct estimation of the production function: (1) simultaneous equation bias is avoided because inputs are dependent variables in cost or profit function estimation equations, rather than being treated as an independent variable, as in the production function approach; and (2) input demand equations can easily be derived from cost or profit functions using Shepherd's or Hotelling's Lemma (for a detailed discussion of the dual approach, see Fuss and McFadden, 1978).

First we consider a Cobb-Douglas profit function and a translog cost function. The "normalized" Cobb-Douglas profit function is of the form

$$(3.B.1.3) \quad \pi(q_1,\ldots,q_n, Z_1,\ldots,Z_m) = b_0\, q_1^{b_1} \ldots q_n^{b_n}\, z_1^{d_1} \ldots z_m^{d_m}$$

where $q_i = w_i/p$, w_i is the ith input price, p is product price and the z_i are fixed inputs. Hotelling's Lemma states that the input demand function are given by $\frac{\partial \pi}{\partial q_i} = -x_i$, which in the case of the Cobb-Douglas function is, in logarithmic form,

$$(3.B.1.4)\quad \log x_i = \log(-b_0 b_i) + \sum_{j=1}^{n} b_j \log(q_j) - \log(q_i) + \sum_{j=1}^{m} d_j \log(z_j)$$

By adding random error terms to these equations they can be estimated as a system of seemingly unrelated regressions (Zellner 1962). Since it can be shown that the Cobb-Douglas production and profit functions are self-dual (that is, they have the same functional form) it is possible to impose cross-equation restrictions on the input demand equation parameters.

Estimates of the unrestricted input demand functions derived from the Cobb-Douglas profit function are presented in Tables 3-3 to 3-6. The model has been specified with prices for mechanical power, animal power, hired labor, manure, nitrogen fertilizer, and phosphate fertilizer. The acreage under cultivation and the family input are included in the model as fixed factors of production. This would appear to be a reasonable assumption for the land variable, especially in terms of the short-run production problem. Also, the governmental crop rotation imposes a constraint on the acreage under cultivation. The family labor variable should not be included as a fixed factor, strictly speaking. However, without information on the opportunity cost of family labor we cannot estimate an input demand function for family labor and, therefore, we treat family labor input as a fixed factor throughout the following analysis. In the short-run the assumption that family labor is a fixed factor is probably not unreasonable. In interpreting the estimates in Tables 3-3 through 3-6, the reader should note that the log-linear form of the equations implies that the parameters are the (constant) input price elasticities. These estimates exhibit several interesting properties which we should note. First, virtually all of the statistically significant own price elasticities of demand are negative, as we would expect, except for a few exceptions. In terms of cross price elasticities there are also a number of interesting relationships. In terms of hired labor the statistically significant positive cross elasticities of mechanical power and animal power with respect to hired labor suggests substitution between these inputs. One exception here is the negative cross elasticity of the wage rate in the mechanical power equation for wheat. It is also interesting to notice that there is a positive cross elasticity of mechanical power with respect to the cost of animal power for rice and cotton, whereas the cross elasticity of animal power with respect to the price of mechanical power is positive only for cotton. Therefore, in the case of cotton it appears that an increase in the price of either hired labor or animal power induces substitution toward mechanical power input. However, this relationship is not uniform across all crops; for example, wheat and maize appear to exhibit complementarity between animal power and mechanical power rather than substitution. We also note that there is a uniform and statistically significant positive effect of acreage size on input demand, as one would expect. There are interesting relationships between family labor input and other input demands. In particular, there appears to be complementarity across all crops between family labor input and mechanical power and animal power input. There also appears to be uniform substitution between family labor and hired labor for these four crops, and substitution between family labor and fertilizer inputs; substitution between hired labor and these inputs also seems to be typical.

Overall, the most important feature of these input demands estimates is that there does appear to be substantial price elasticity both in terms of own price elasticities and cross price elasticities of input demand. For example, the nitrogen fertilizer input demand elasticities vary from -.63 to -1.44, suggesting substantial demand elasticity for nitrogen fertilizer. The same appears to be true for hired labor, where the elasticity estimates appear to vary from zero to possibly as high as -4 in the case of maize. Animal power input exhibits substantial demand elasticity as does mechanical power. These demand elasticities provide clear evidence that farmers do respond in an economically rational way. It follows that output supply should also respond to changes in input prices as conventional economic theory would suggest.

Second, we consider the estimates of the translog cost function:

$$\log C = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log w_i + \frac{1}{2} \sum_{i}^{n} \sum_{j}^{n} \alpha_{ij} \log w_i \log w_j + \beta \log Q + \sum_{i}^{n} \sum_{j}^{m} \beta_{ij} \log w_i \log z_j \quad (3.B.1.5)$$

Differentiating log C with respect to $\log w_k$ we have

$$\frac{\partial \log C}{\partial \log w_k} = \alpha_k + \sum_{j \neq k}^{n} \alpha_{jk} \log w_i + \sum_{j}^{m} \beta_{jk} \log z_j \quad (3.B.1.6)$$

Shepherd's Lemma states that input demands are

$$\frac{\partial C}{\partial w_k} = X_k \quad (3.B.1.7)$$

which implies

$$\frac{\partial \log C}{\partial \log w_k} = \frac{\partial C}{\partial w_k} \frac{w_k}{C} = \frac{X_k w_k}{C} \equiv s_k \quad (3.B.1.8)$$

That is, the share of the kth input in total cost is the function (3.B.1.6). Therefore, the parameters α_i, α_{ij}, and β_{ij} can be estimated by regressing the input cost shares s_i on logs of input prices and fixed inputs. The system of equations (3.B.1.6) can be efficiently estimated as a system of seemingly unrelated regressions. It can easily be verified that the translog function (3.B.1.5) is not a globally convex function of input prices; rather, it can be interpreted as a local second-order approximation to the true cost function. To verify that it is a concave function, it is sufficient to show that matrix of Allen elasticities of substitution is positive definite (Binswanger 1974).

The system of equations (3.B.1.6) is characterized by symmetry of the α_{ij} parameters.

Tables 3-7 to 3-10 present parameter estimates of the translog cost functions for rice, cotton, maize and wheat. Rather than interpreting these parameter estimates directly, we shall refer to Tables 3-11 to 3-14 which contain input demand elasticities based on the cost function estimates, and Tables 3-15 to 3-18 which contain estimates of elasticities of substitution. Several features of these elasticity estimates should be noted. First, all the statistically significant own-price input demand elasticities are negative, as predicted by economic theory, except for the case of mechanical power demand for wheat.[1]

Second, the cross elasticities of demand for mechanical power, animal power, and hired labor are of definite interest. For rice, maize, and wheat mechanical power and animal power have negative cross-price elasticities of demand which means they are conplementary inputs; for cotton the positive elasticities suggest these two inputs substitute for each other. Hired labor appears to substitute for mechanical power in all crops but possibly wheat, and substitutes for animal power in rice, maize and wheat but is strongly complementary to animal power in cotton. Third, the demand elasticities for nitrogen fertilizer are significant and negative for rice, cotton, and maize; only for wheat is an insignificant coefficient obtained. As with the Cobb-Douglas profit function estimates, the demand elasticity for nitrogen appears to be in the -.5 to -1.5 range.

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[1]In fact, in the case of wheat several of the elasticities are positive but statistically insignificant; since this result was also obtained with the Cobb-Douglas profit function estimates (see Table 3-6) we should interpret the wheat estimates with caution. These anomalous results may be due to data errors.

Tables 3-15 to 3-18 contain elasticities of substitution implied by the translog cost function estimates. These elasticities are of interest as they allow us to test the null hypothesis that the production function is Cobb-Douglas. Under a Cobb-Douglas technology all elasticities of substitution are one; as Tables 3-15 to 3-18 show, this hypothesis appears to be rejected by the data.

3.B.2 Implications of the Empirical Analysis

We can now examine the economic implications of the profit function and cost function estimates and relate them to relevant issues in agricultural policy. A first overall implication is that both the profit function and cost function estimates show substantial price responsiveness of input demands to input price changes. In addition, the profit function estimates indicate substantial responsiveness of input demand to changes in the product price. To see this, we note that the elasticity of input demand with respect to product price equals minus the sum of the input price elasticities. For example, in the case of rice the profit function estimates suggest that the elasticity of nitrogen fertilizer demand with respect to output price is about two. Therefore, an increase in the price of rice would induce a relatively large increase in the demand for nitrogen fertilizer applications to rice. The same relationship appears to be true for maize and cotton, although the effect would appear to be relatively small on wheat. It should be noticed that this effect of product price change on the demand for fertilizer is valid <u>holding constant</u> all other inputs, and therefore, is only a short-run elasticity. In the longer run it is likely that the response to fertilizer demand would be even greater as more land and other resources were allocated to crops in response to the price increase. Thus, as the theoretical analysis of Section 3.A.2 suggested, it seems clear that farmers' demand for fertilizer is a function of input and product prices. In fact, the data show that there is a very large variation in the amount of fertilizer used per feddan. Figures 3-6 present histograms for nitrogren fertilizer used per feddan, and clearly show that most farmers do deviate from the government quotas given in Part II (see Table 2-7). This behavior can be explained by the variations in local growing conditions and local prices farmers face. The fact that more farmers appear to use less fertilizer than the quota for these crops suggests that they are responding rationally to the relatively low product price for these crops set by the government, by allocating their fertilizer to other crops such as vegetables which have free market prices and, hence, a higher rate of return to the fertilizer input.

Another important implication of the cost function and profit function estimates concerns the substitution possibilities between hired labor, animal power, mechanical power, and family labor. The estimates show substantial substitution possibilities between these inputs. In particular, there appears to be significant possibility for substitution between labor and mechanical power, animal power, and mechanical power, and in some cases labor and animal power. However, the estimates do suggest complex interrelationships between these three inputs which differ across crops. Nevertheless, there is a consistent pattern of complementarity between family labor, mechanical power, and animal power, and substitution between family labor and hired labor. Further research and more data may be required to estimate these relationships with more precision and to identify more accurately the magnitudes of these relationships.

3.C Evidence of Technical Change in Egyptian Agriculture and its Economic Implications

In this section we briefly survey some of the existing evidence of technical change--or the lack thereof--in Egyptian agriculture over the past decade and a half. We examine three types of data which provide information about technical change: data on agricultural research activity, data on yield trends, and cost of production data. We view the issue of technical change to be critical to understanding the productivity problem and the Egyptian agricultural sector. Schultz's model of agricultural development discussed in Section 3.A shows that technical change is a necessary condition for productivity growth in the agricultural sector of any country. However, as we now show, the evidence suggests that there was little technical change in Egyptian agriculture during the period 1965 through 1979. Moreover, the evidence clearly indicates that in crops for which some technical change has occurred, government price policy has discouraged production, and instead encouraged production of crops for which little or no productivity growth has occurred. The evidence suggests, therefore, that one of the first priorities for Egyptian agricultural policy should be to mobilize resources for the basic and applied agricultural research which is necessary for productivity growth in the agricultural sector, and to pursue price policies which encourage, rather than discourage, production, and especially encourage production of crops for which significant productivity growth is taking place.

3.C.1 Yield Trends in Egyptian Agriculture, 1965 through 1979

In Table 3-19 area and yield trends are summarized for major crops and vegetables. The first notable feature of these data are the very low yield trends for vegetables and maize. Only cotton, wheat, and rice have experienced substantial productivity growth. The importance of agricultural price policy to the productivity problem can be seen by examining the trends in the area cultivated. Since price policy and quotas have had the effect of heavily taxing the production of cotton, and to a lesser degree other crops such as rice and wheat, the areas devoted to these crops has either declined at a rapid rate (minus 20 percent in the case of cotton) or increased very slowly (0.7 and -2.1 percent in the case of summer and Nile rice, 4.4 percent in the case of wheat). Thus, the area planted to crops with high productivity growth has not increased substantially due to the government price policy. On the other hand, vegetable acreage has grown at an amazing rate apparently because vegetable production is not heavily taxed. However, vegetable yields have not grown at a high rate in most cases, and in several cases, yields have actually declined. In sum, it would appear that Egyptian agricultural policy is serving to discourage production of those crops where technical change is taking place, and is encouraging in crops where productivity is not increasing. Clearly, this policy is partly accountable for slow overall rate of productivity growth in Egyptian agriculture.

3.C.2 Agricultural Research Activity

There is relatively little data currently available concerning the level of agricultural research activity, and more important, the level of agricultural research productivity, in Egypt. One available measure of research activity is publications in agricultural sciences. Table 3-20 are presents average numbers of research publications in varying fields reported by the Institute of Agricultural Research. Examination of this table suggests that while the trend in research is generally upwards, there is not a strong upwards trend in many of the fields of research. Moreover, in the 70's it appears that the publication rate declined (likely due to the 1973 war).

These data suggest that research activity, while increasing over this period, has not shown substantial increases particularly in the period of 1966 through 1977. Overall, it is, of course, very difficult to assess these kinds of data because it is difficult to measure the quality of the research effort rather than simply the quantity of research effort. For example, data compiled by Boyce and Evenson (1975) show that the number of scientist-man years devoted to agricultural research in Egypt doubled from 1959 to 1974. Also, expenditures on agricultural research in real terms approximately doubled from 1959 to 1974. This suggests that the amount of resources devoted to agricultural research increased substantially over the past two decades. Thus, it is difficult to assess the overall research record of research institutions in Egypt over the past 20 years.

3.C.3 Cost of Production Data

Another indicator of the level of agricultural technology and the rate of technical change in Egyptian agriculture is the share of inputs in total cost. Since the traditional technology depends largely on human labor, animal power, and organic fertilizer, while the newer technologies involve chemical fertilizers, mechanical power, and pesticides, the level and rate of change over time of these input cost shares indicate the type of technology being used.

Tables 2-24 to 2-27 show average cost data per feddan at the aggregate level for rice production 1965-1979. It is evident from these data that over the period of 1965 through 1979 there have not been substantial trends in the cost shares of either traditional or modern inputs except perhaps for mechanical power. Similar data for cotton show that the labor share has been roughly 50 percent over the entire period while animal power declined from about 10 percent to 5 percent and mechanical power increased from about 5 percent to 10 percent; at the same time chemical fertilizers and insecticides declined somewhat. Thus, while the mechanical power share doubled, it remains a relatively small share of total cost, and other modern inputs shares have declined. In light of the Egyptian government's price policies for cotton, the downward trend in cost shares of chemical fertilizer inputs and insecticides is not surprising and is consistent with the profit and cost function estimates presented in Section 3.B above. For other crops the pattern is very similar. Wheat shows the greatest growth in mechnical power input, with clear evidence of substitution of mechanical power for animal power. Maize and rice follow much the same pattern. Tables 2-10 to 2-12 show pesticides as a percent of total cost have increased for some crops but remained roughly constant for all Egypt, as was total consumption of pesticides.

While these data are only suggestive, they do corroborate the other evidence presented concerning technical change in Egyptian agriculture. There is evidence of some technical change during the 1965 through 1979 period, but the data suggest that the changes have not been substantial. The cost share data show the trend toward some mechanization but the share of mechanization in total cost remains small. The trends of other modern inputs are constant or even downward, as in the case of chemical fertilizers. Of the four major crops, wheat appears to be the most technically advanced in terms of mechanization and chemical fertilizer input. These findings are also consistent with the yield trend data which show wheat yield increased at an average rate of 14 percent over the 1965 through 1979 period, as compared to 10 percent for cotton, 6 percent for rice, and near 0 for maize. Overall, therefore, the evidence suggests that the Egyptian agricultural sector is characterized by a "semi-traditional" agricultural technology. The semi-traditional technology is characterized by some elements of both the traditional technology and the modern technology.

Moreover, the agricultural technology in Egypt during the past decade and a half appears to be relatively static, as in a traditional agriculture. While some productivity trends are evident, as in the yield increases of wheat and cotton, it is also clear that there exists a large gap between the current agricultural technology in Egypt and the degree of modernization that might be possible in the Egyptian agricultural sector.

cg Part I & II C-21
cg Part III & Ref. P-28
cg Tables D-4, C-22, P-36
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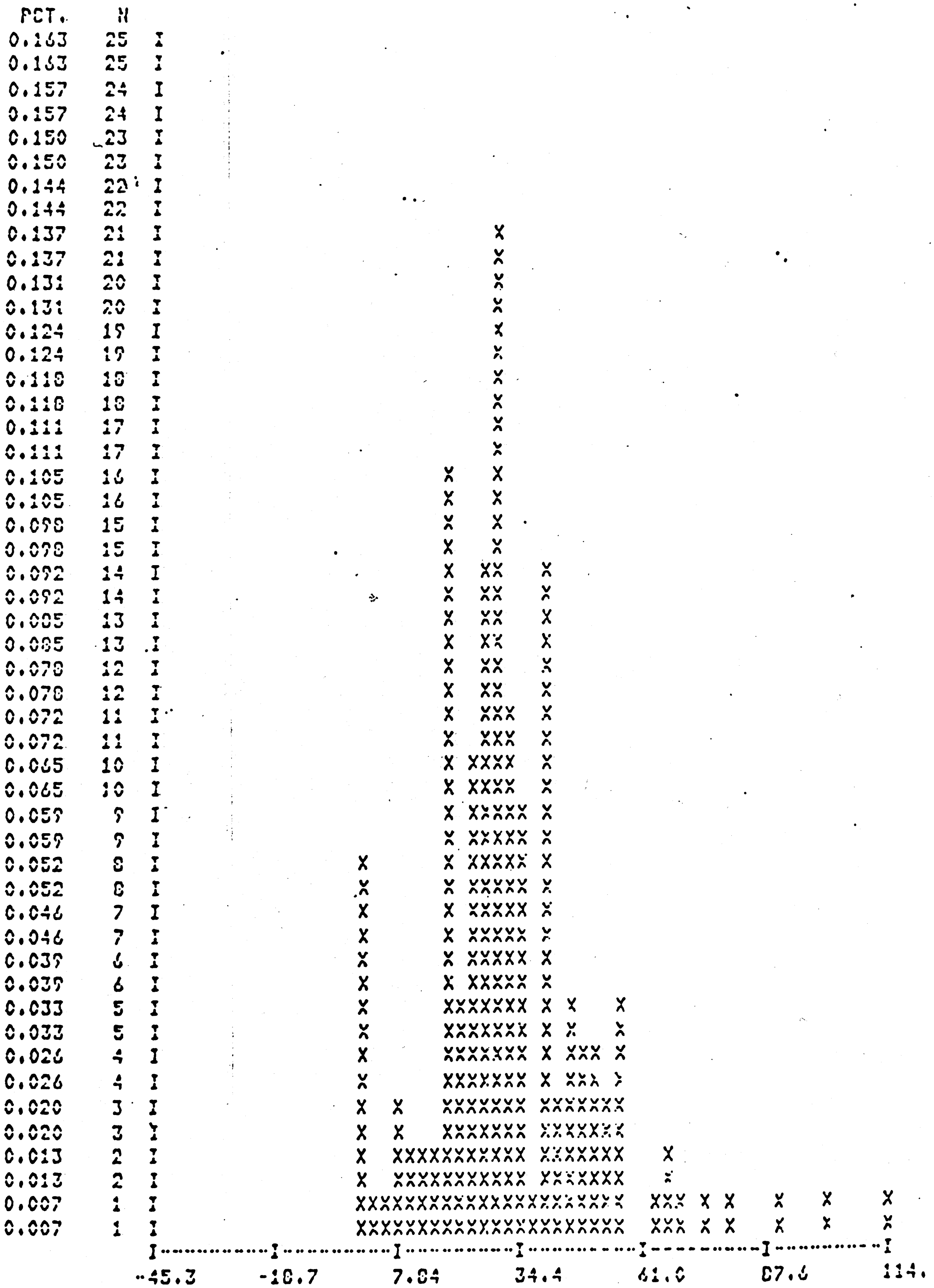

Figure 3. Histogram of Nitrogen Fertilizer per Feddan.

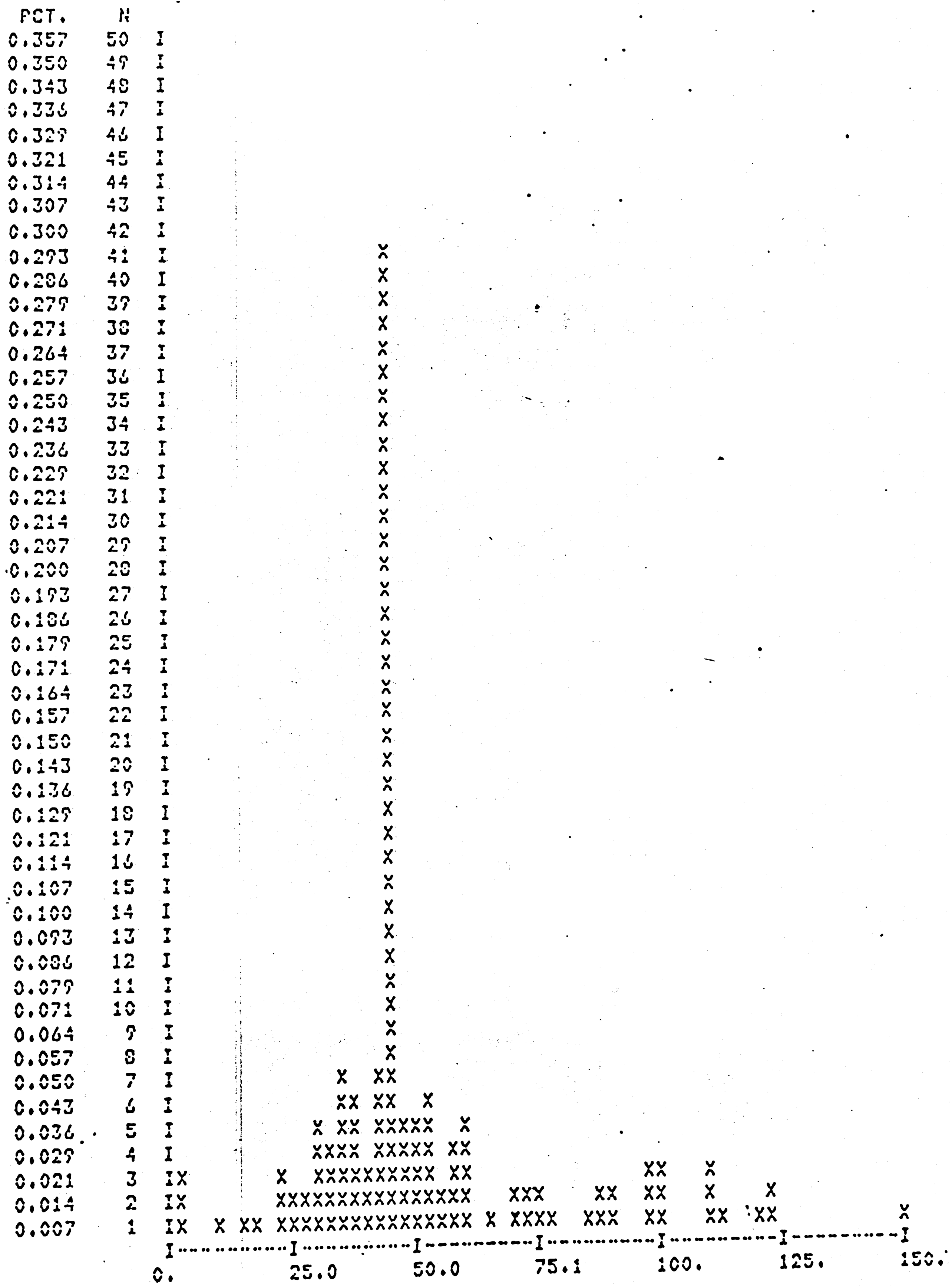

Figure 4: Histogram of Cotton Fertilizer per Feddan.

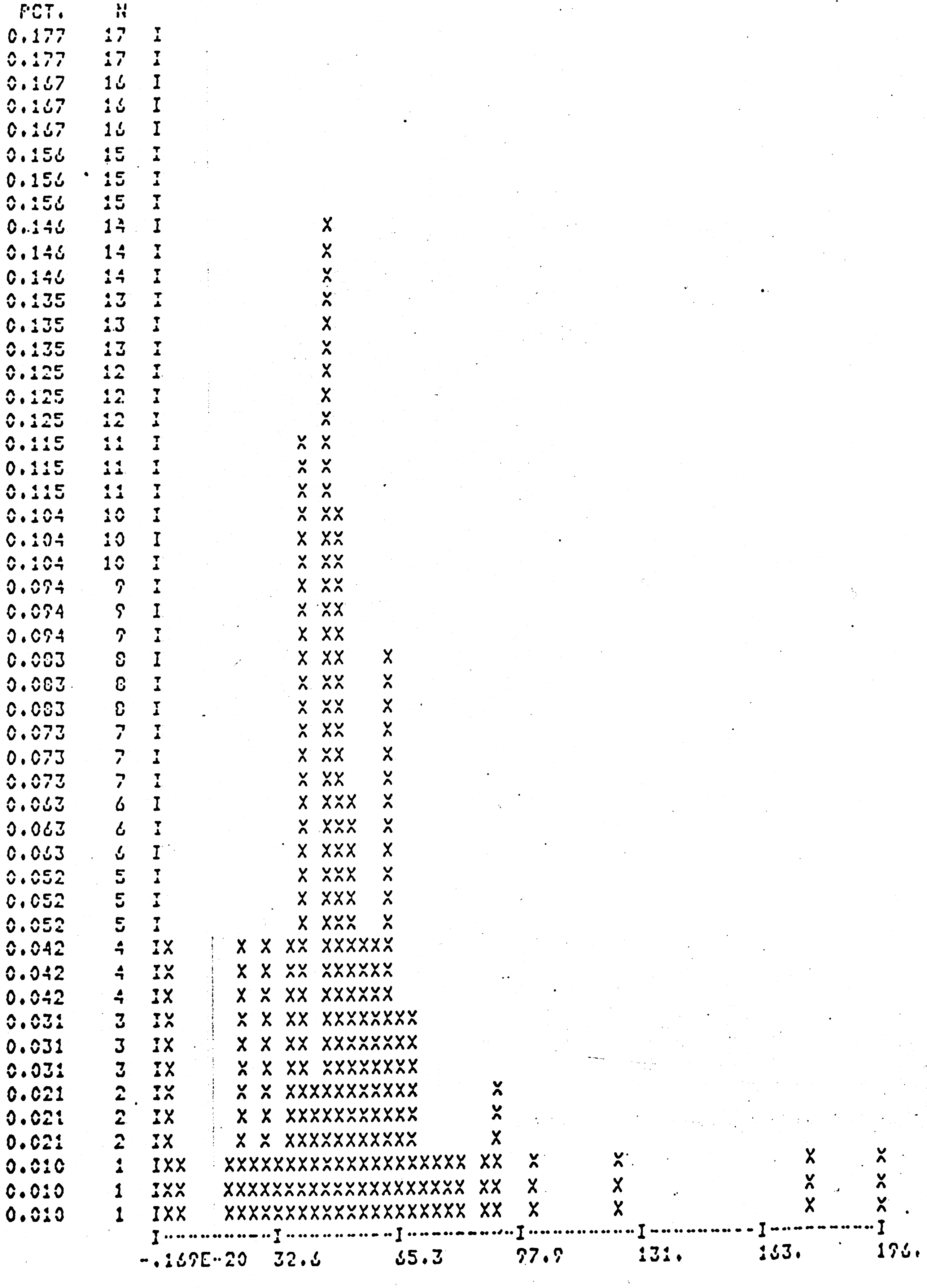

Figure 5: Histogram of Maize Fertilizer per Feddan.

```
PCT.    N
0.214   25  I
0.214   25  I
0.205   24  I
0.205   24  I
0.197   23  I
0.197   23  I
0.188   22  I
0.188   22  I
0.179   21  I                     X
0.179   21  I                     X
0.171   20  I                     X
0.171   20  I                     X
0.162   19  I                     X
0.162   19  I                     X
0.154   18  I                     X
0.154   18  I                     X
0.145   17  I                     X
0.145   17  I                     X
0.137   16  I                     X
0.137   16  I                     X
0.128   15  I                     X
0.128   15  I                     X
0.120   14  I                     X
0.120   14  I                     X
0.111   13  I                     X
0.111   13  I                     X
0.103   12  I                     X
0.103   12  I                     X
0.094   11  I              X      X
0.094   11  I              X      X
0.085   10  I              X      X
0.085   10  I              X      X
0.077    9  I              XX     X
0.077    9  I              XX     X
0.068    8  I              XX     X
0.068    8  I              XX     X
0.060    7  IX            XXX    XX
0.060    7  IX            XXX    XX
0.051    6  IX            XXX    XX
0.051    6  IX            XXX    XX
0.043    5  IX            XXX  X XX       X
0.043    5  IX            XXX  X XX       X
0.034    4  IX            XXX  XXXX X   X X
0.034    4  IX            XXX  XXXX X   X X
0.026    3  IX            XXX XXXXXXX   X X X
0.026    3  IX            XXX XXXXXXX   X X X
0.017    2  IX        X X XXXXXXXXXXX XXXXX X
0.017    2  IX        X X XXXXXXXXXXX XXXXX X
0.009    1  IXX X X X XXXXXXXXXXXXXXX XXXXXXXX X         X         X    X
0.009    1  IXX X X X XXXXXXXXXXXXXXX XXXXXXXX X         X         X    X
            I---------I---------I---------I---------I---------I---------I
            .212E-21  20.7      41.3      62.0      82.7      103.      124.
```

Figure 6: Histogram of Wheat Fertilizer per Feddan.

Table 1-1

Value of Agricultural Income and Agricultural Production and as a Percentage of National Income, Egypt, 1965-1978.
(Million L.E.)

Year	National Income	Agr. Income		Value of Production	
			--%--		--%--
1965	1975.0	612	30.99	801	40.56
1966	2124.1	670	31.54	874	41.15
1967	2194.8	697	31.76	903	41.14
1968	2187.8	670	30.62	901	41.18
1969	2339.4	729	31.16	970	41.46
1970	2552.8	783	30.67	1048	41.05
1971	2700.5	817	30.25	1123	41.58
1972	2956.5	905	30.61	1223	41.37
1973	3216.9	1020	31.71	1391	43.24
1974	3644.1	1233	33.84	1686	46.27
1975	4445.0	1382	31.09	1870	42.07
1976	5536.5	1661	30.00	2201	39.75
1977	6613.7	1950	29.50	2626	39.71
1978	8119.1	2189	26.96	3250	40.03

Source: Agr. Economic Research Institute, Agr. Research Center, Ministry of Agr., 1965-1978.

Table 1-2

Value of Agricultural Commodities as a Percentage of Total Agricultural Production, Egypt, 1965-1978.
(Million L.E.)

Years	Source of Income				
	Field Crops	Vegetables	Fruits	Livestock	Total Value of Agr. Production
1965	59.05	9.74	4.62	26.47	801
1966	57.44	11.44	4.58	26.43	874
1967	57.14	10.30	4.43	28.02	903
1968	61.38	11.32	4.11	23.09	901
1969	61.55	10.82	4.54	22.99	970
1970	58.78	10.59	3.91	26.53	1048
1971	58.59	10.15	4.72	26.36	1123
1972	56.99	11.77	4.99	26.00	1223
1973	56.51	12.72	4.96	25.52	1391
1974	56.06	14.23	4.86	24.38	1686
1975	53.58	13.16	5.13	27.54	1870
1976	51.02	14.54	5.54	28.44	2201
1977	52.21	14.39	5.06	27.84	2626
1978	55.35	12.62	5.29	26.06	3250

Source: See Table 1-1.

Table 1-3

Value of Major Field Crops in Egypt as a Percentage of Total Agricultural Production, 1965-1978. (Million L.E.)

Year	Cotton	Wheat	Maize	Rice	Total
	-----------------------	----------	%	----------	----------
1965	19.5	7.1	7.9	5.0	39.5
1966	15.7	8.4	9.5	5.4	39.0
1967	15.0	6.9	9.3	7.9	39.1
1968	15.5	6.8	8.1	9.3	39.7
1969	18.0	5.6	9.0	8.5	41.1
1970	16.9	7.5	8.1	7.4	38.9
1971	15.1	7.0	7.6	6.4	36.1
1972	15.1	6.0	7.9	5.7	34.7
1973	12.7	6.7	8.8	4.8	33.0
1974	11.2	7.6	8.5	4.9	32.2
1975	9.6	7.7	8.1	5.6	31.0
1976	6.5	5.8	7.6	5.5	29.4
1977	9.7	5.8	8.9	5.2	29.6
1978	8.5	6.9	7.6	5.0	28.0

Source: Table 1-1.

Table 1-4

Cropping Pattern for Major Field Crops in Egypt, 1965-1979.

Year	Total Cultivated Area	Cotton		Wheat		Maize		Rice	
		Area	%	Area	%	Area	%	Area	%
1965	10261	1900	18.5	1144	11.2	1451	14.1	1191	11.6
1966	10488	1859	17.7	1291	12.3	1575	15.0	1204	11.5
1967	10462	1626	15.5	1245	11.9	1485	14.2	1075	10.3
1968	10740	1464	13.6	1413	13.2	1554	14.5	1204	11.5
1969	10732	1622	15.1	1246	11.6	1484	13.8	1192	11.1
1970	10746	1627	15.1	1305	12.1	1503	14.0	1142	10.7
1971	10742	1525	14.2	1349	13.6	1522	14.2	1137	10.6
1972	10831	1552	14.3	1239	11.4	1532	14.1	1146	10.6
1973	10923	1600	14.7	1248	11.4	1654	15.1	997	9.1
1974	11026	1453	13.2	1370	12.4	1755	15.9	1053	9.5
1975	11162	1346	12.1	1394	12.5	1830	16.4	1053	9.4
1976	11198	1248	11.1	1396	12.5	1891	16.9	1079	9.6
1977	11111	1423	12.8	1207	10.9	1765	15.9	1040	9.4
1978	11142	1189	10.7	1381	12.4	1898	17.0	1031	9.3
1979	11235	1196	10.7	1391	12.4	1885	16.8	1040	9.3

Source: See Table 1-1.

Table 1-5

Total Cost and Net Return for Cotton, Wheat, Maize and Rice, Egypt, 1965-1978.
(L.E./Feddan)

Year	Cotton		Wheat		Maize		Rice	
	Total Cost	Net Return	Total Cost	Net Return	Total Cost	Net Return	Total Cost	Net Return
1970	51.54	51.35	39.94	19.39	41.50	19.90	36.80	30.24
1971	55.41	55.14	39.9y	18.10	41.46	20.00	36.95	26.85
1972	47.41	71.98	40.96	18.84	44.40	25.18	36.55	24.39
1973	51.23	59.38	42.22	32.04	45.08	35.31	39.87	28.72
1974	60.88	68.48	47.55	45.88	50.99	35.65	45.05	35.41
1975	74.66	57.85	48.37	54.00	59.52	29.17	55.31	43.21
1976	90.80	92.66	65.17	26.66	71.01	22.16	68.72	42.67
1977	101.76	76.83	75.85	50.63	75.11	64.13	73.48	45.66
1978	117.41	114.93	88.44	74.31	102.93	38.70	81.73	78.80
1979	141.75	192.31	97.71	48.93	—	—	101.73	68.81

Source: See Table 1-1.

Table 1-6

Relative Importance of Major Export Crops with Respect to Total Exports in Egypt and Total Exports in Agriculture, 1965-1979.
(Million L.E.)

Year	Total Exports in Egypt (1)	Total Exports in Agriculture (2)		Cotton			Rice			Onion			Potato		
			-%-	Value	(1) -%-	(2) -%-	Value	(1) -%-	(2) -%-	Value	(1) -%-	(2) -%-	Value	(1) -%-	(2) -%-
1965	263,132	181,400	68.9	146,200	55.6	80.6	19,800	7.5	10.9	6,800	2.6	3.8	1,200	0.5	0.7
1966	263,135	180,900	68.8	143,400	54.5	79.3	21,200	8.1	11.7	6,200	2.4	3.4	2,500	1.0	1.4
1967	246,203	168,700	68.5	121,600	49.4	72.1	29,800	12.1	17.7	8,900	3.6	5.3	1,400	0.6	0.8
1968	270,295	180,900	66.9	121,100	44.8	66.9	44,900	16.6	24.8	6,100	2.3	3.4	900	0.3	0.5
1969	323,929	211,100	65.2	130,700	40.4	61.9	55,300	17.1	26.2	7,800	2.4	3.7	2,500	0.8	1.2
1970	331,178	208,600	63.0	147,900	44.7	70.9	34,200	10.3	16.4	7,300	2.2	3.5	3,700	1.1	1.8
1971	343,177	224,200	65.3	175,000	51.0	78.1	24,500	7.1	10.9	5,800	1.7	2.6	2,000	0.6	0.9
1972	358,775	206,400	57.5	162,000	45.2	78.5	22,100	6.2	10.7	5,000	1.4	2.4	3,200	0.9	1.6
1973	444,197	264,200	59.5	191,900	43.2	72.6	26,200	5.9	9.9	10,800	2.4	4.1	6,600	1.5	2.5
1974	593,299	357,400	60.2	279,100	47.0	78.1	39,700	6.7	11.1	9,900	1.7	2.8	5,900	1.0	1.7
1975	548,585	271,500	49.5	201,000	36.6	74.0	24,200	4.4	8.9	8,900	1.6	3.3	3,200	0.6	1.2
1976	595,450	252,700	42.4	154,800	26.0	61.3	31,000	5.2	12.3	10,200	1.7	4.0	17,200	2.9	6.8
1977	668,478	285,300	42.7	182,300	27.3	63.9	23,300	3.5	8.2	11,100	1.7	3.9	16,400	2.5	5.8
1978	679,754	224,500	33.0	131,500	19.4	58.6	19,900	2.9	8.9	9,100	1.3	4.1	5,800	0.9	2.6
1979	1,287,805	377,000	29.3	267,300	20.8	70.9	22,100	1.7	5.9	8,400	0.7	2.2	18,800	1.5	5.0

Source: Monthly Bulletin of Foreign Trade, Central Agency for Public Mobilzation and Statistics, 1965-1979.

Table 1-7

Relative Importance of Wheat and Maize Imports, 1965-1979.
(Million L.E.)

Year	Total Exports in Egypt (1)	Total Imports in Agriculture (2)		Wheat			Maize		
				Value	(1)	(2)	Value	(1)	(2)
			--%--		-%--	-%--		-%--	-%--
1965	405.9	110.2	27.15	61.7	15.2	55.99	—	--	--
1966	465.9	126.1	27.07	65.4	14.1	51.86	—	--	--
1967	344.2	137.7	40.01	78.2	22.7	56.79	—	--	--
1968	289.6	91.9	31.73	59.3	20.5	64.53	3.5	1.21	3.81
1969	277.3	66.2	23.87	38.6	13.9	58.31	1.2	0.43	1.81
1970	342.0	72.6	21.23	28.5	8.3	39.26	1.9	0.56	2.62
1971	399.8	110.9	27.74	69.6	17.4	62.76	1.1	0.28	0.99
1972	390.5	102.6	26.27	49.4	12.6	48.15	2.4	0.61	2.34
1973	361.2	104.0	28.79	65.7	18.2	63.17	2.5	0.69	2.40
1974	920.1	397.7	43.22	262.0	28.5	65.88	27.0	2.93	6.79
1975	1,539.3	534.9	34.75	260.0	16.9	48.61	27.1	1.76	5.07
1976	1,489.9	405.0	27.18	190.0	12.8	46.91	30.8	2.07	7.60
1977	1,884.3	399.6	21.21	178.0	9.4	44.54	30.0	1.59	7.51
1978	2,632.2	538.0	20.44	240.8	9.17	44.76	38.0	1.44	7.06
1979	2,686.2	—	—	243.0	9.04	—	--	--	--

Source: Table 1-6.

Table 2-1

Local Production of N and P_2O_5 Fertilizers
(1000 Tons)

Year	Nitragenous Fertilizers		Phorphorus Fertilizers	
	Q_{000}'s units	V LE	Q	V_{000}'LE
1965	153.2	20,216,200	284.4	3104.9
1966	163.3	21,231,000	304.9	3336.
1967	158.6	19,761,800	343.6	3311.9
1968	169.4	20,662,000	362.2	3706.4
1969	124.6	14,703,000	382.8	4270.
1970	119.4	14,376,600	432.9	4606.
1971	117.3	13,578,400	520.4	5603.3
1972	90.3	10,548,000	561.7	6307.
1973	65.6	7,615,000	456.7	5378.
1974	100.5	11,660,000	499.0	6364.
1975	125.	14,385,000	551.3	7104.
1976	169.9	19,603,000	490.0	6581.
1977	195.	22,777,000	508.	8048.
1978	216.5	25,311,000	494.2	8807.

Source: Economic Magazine, 1980

Table 2-2

Fertilizer Imports and Exports, 1965-1978

Years	Imports		Exports	
	Q 000's Ton	V 000'LE	Q 000's Ton	V 000's LE
1965	603.9	12.319	24	246
1966	576.1	11.752	38	364
1967	224.6	3.626	34.5	289
1968	411.1	7.023	29.7	252
1969	294.6	5.061	39.1	352
1970	198.8	3.588	93	785
1971	437.3	5.703	78.7	627
1972	274.3	3.846	117.3	907
1973	404.5	9.106	59.3	543
1974	518.9	29.255	32.6	250
1975	423.8	37.137	26.9	437
1976	433.3	17.381	31.2	321
1977	491.8	15.287	23.4	245
1978	643.2	22.926	25.2	177

Source: Economic Magazine

Table 2-3

Average Variable Cost and Fertilizer Value Per Feddan
for Major Crop in A.R.E.

Years	Maize			Cotton			Wheat			Rice		
	A.V.C.	F.V.	%	A.V.C.	F.V.	%	A.V.C.	F.V.	%	A.V.C.	F.V.	%
1965	22.3	3.6	16.2	41.4	5.1	12.1	23.1	4.3	18.6	32.2	4.2	13
1966	25.1	4.8	19.1	48.2	6.5	13.5	24.6	5.5	22.4	35.6	5.1	14.3
1967	27.4	6.1	22.2	46.6	6.6	14.2	25.1	5.4	21.5	35.9	5	13.9
1968	28	6.2	22	47.1	6.6	14	25.2	5.5	21.8	37.8	5.4	14.3
1969	28.3	6.3	22.3	49.7	6.9	13.9	24.6	5.6	22.8	37.2	5.4	14.5
1970	29	6.9	23.8	51.5	7.8	15.2	24.8	5.7	23	36.9	5.7	15.5
1971	29.2	6.8	23.2	55.5	7.7	13.9	24.5	5.8	23.7	36.9	5.4	14.6
1972	31.6	7.3	23.2	47.4	7.7	16.5	25.5	6.1	23.9	36.5	5.5	15
1973	32.5	7.2	22.2	51.4	8.4	16.3	26.7	6.5	24.3	39	6	15.4
1974	37.7	7.5	19.9	61	8.1	13.3	31.3	8.3	26.7	45.2	5.5	12.2
1975	44.5	7.6	17.1	74.7	8.5	11.4	42.3	7.1	16.8	55.4	6.1	11
1976	52.1	7.7	14.8	90.8	9.2	10.1	46.8	8	17.1	68.6	6.5	9.5
1977	65.4	10.4	15.9	101.8	9.1	8.9	54.3	8.7	16	73.6	6.4	8.7
1978	81.3	10.5	12.9	117.5	10.8	9.2	65.7	9.1	13.9	81.7	7.5	9.2
1979				141.8	11.6	8.2	73.6	9.5	12.9	101.7	8.3	8.2

A.V.C. = Average Variable Cost
F.V. = Value of Fertilizer

Source: Agricultural Economic Research Institute, Agricultural Research Center, Ministry of Agriculture 1965-1979.

Table 2-4

The Consumption of Fertilizers
for Major Crops
(000's Tons)

Years	Cotton				Rice				Wheat			Maize
	N	P_2O_5	P	Total	N	P_2O_5	P	Total	N	P_2O_5	Total	M
69/70	380	71			250	50	2		342			455
70/71	398	68			273	51	2		408			504
71/72	403	80			238	59	2		373			507
72/73	441	98			210	61	2		428			567
73/74	431	59			192	42	2		408	55		625
74/75	446	57	3		215	45	1		462	60		746
75/76	446	66	5		220	58	1		463	74		772

Table 2-5

The Value of Fertilizers Consumption for Major Crops

Years	Cotton				Rice				Wheat			Maize
	N	P_2O_5	P	Total	N	P_2O_5	B	Total	N	P_2O_5	Total	(N)
69/70	7630	861		8491	5029	614	39	5672	6872		6872	9129
70/71	8011	878		8889	4778	655	50	5483	8206		8206	10149
71/72	8118	1157		9275	4793	853	39	5685	7504		7504	10205
72/73	8887	1419		10306	4229	884	50	5163	8607		8607	11409
73/74	8861	842		9703	3950	611	47	4609	8382	796	9178	12841
74/75	8989	832	78	9894	4327	651	8	4986	9310	822	10172	15041
75/76	8947	971	121	10039	4419	839	13	5271	9293	1086	10379	15497

Source: Chemical Fertilizers in the World 1976

Table 2-6

The Consumption of Chemical Fertilizers in Egypt
1963-1972

Years	Nitrogenous		Phosphate	Batasin
	000' Ton	000's Unit	000's Ton	000's Ton
1963	984	196	252	3
1964	1157	227	291	2
1965	1231	256	320	2
1966	1294	285	348	1
1967	1100	244	289	1
1968	997	234	229	2
1969	1084	281	249	2
1970	936	310	234	3
1971	966	331	268	4
1972	975	325	309	3

Source: Chemical Fertilizers in the World (1976)

Table 2-7

Fertilizer Quotas for Wheat, Rice, Cotton and Maize
1973-1978
(Kg of 15.5% Nitrogen/feddan)

Crops	1973	1974	1975	1976	1977	1978
Wheat	250-400	250-400	250-400	250-400	250-400	250-400
Rice	200	200	200	200	200	200
Cotton	225-300	225-300	250-400	300-400	300-400	300-400
Maize	250-400	250-400	350-400	350-400	350-400	350-400

Source: Ministry of Agriculture, Agricultural Economic Research Institute, Agricultural Research Center

Table 2-8

Chemical Fertilizer Subsidy
1973-79

Years	Imported Fertilizers 1000 L.E.	Local Fertilizers 1000 L.E.
1973	495	980
1974	46263	3671
1975	72271	6276
1976	30700	9134
1977	10715	13252
1978	12007	15269
1979	42791	19491

Table 2-9

Fertilizer Needs and Fertilizer Quotas

Crops	Nitrogen		P_2O_5	
	Amount Needed*	Quota	Amount Needed*	Quota
P. Bersaim	-	-	15	30
S. Bersaim	-	-	15	15
Wheat	31-46	38.8-62	15	-
Broad Beans	-	7.5	15	-
Barley	15-30	15.5	-	-
Lentil	38-8	53.6	-	15
Onion	31-53	62.0	-	15
Maize	46.0	53.6-62	15-30	-
Cotton	38.8	46-62	23.5	15
Rice	60.5	31.0	15.0	15
Sugar Cane	65.5	100.8	-	-
Sesame	15.5	20-30	-	30

Note: Amount needed as determined by agronomic studies:

(1) Hessien, A.A., Production of Field Crops, Faculty of Agriculture, Cairo University.

(2) Ministry of Agriculture, Agricultural Economic Research Institute, Agricultural Research Center.

Table 2-10

Value of Factors of Production and Relative Importance of Pesticides in 1965-1979 (L.E. Millions)

Years	Value of Factors of Production	Value of Pesticide	Value of Cotton Pesticide	% (1)	% (2)
1965	189	11	9.5	5.82	86.36
1966	204	10		4.90	
1967	206	15	6.8	7.28	45.33
1968	231	9	6.0	3.90	66.67
1969	241	12	9.9	4.98	82.5
1970	265	14	11.1	5.28	79.29
1971	306	23	14.1	7.52	61.3
1972	318	20	6.3	6.29	31.5
1973	371	18	7.5	4.85	41.67
1974	453	22	8.8	4.86	40.0
1975	488	32	10.1	6.56	31.56
1976	540	32	9.1	5.93	28.44
1977	676	38	10.5	5.62	27.63
1978	1061	38	9.1	3.58	23.95

$$(1) = \frac{\text{Value of Pesticides}}{\text{Value of Factors of Production}} \times 100$$

$$(2) = \frac{\text{Value of Cotton Pesticide}}{\text{Value of Pesticides in Agr. Sectors}} \times 100$$

Source: Agricultural Economic Research Institute, Agricultural Research Center, Ministry of Agriculture, 1965-1978.

Table 2-11

Relative Importance of Pesticides Cost in Some Crops
(1965-1979)
(L.E. of Feddan)

Years	Cotton			Maize			Rice		
	T.V.C.	C.P.	%	T.V.C.	C.P.	%	T.V.C.	C.P.	%
1965	41.4	5.0	12.1	22.3	0.3	1.4	-	-	-
1966	48.2	6.9	14.3	25.1	0.4	1.6	-	-	-
1967	46.6	4.2	9.0	27.4	0.2	0.7	-	-	-
1968	47.1	4.1	8.7	28.0	0.1	3.6	-	-	-
1969	49.7	6.1	12.3	28.3	0.1	0.4	-	-	-
1970	51.5	6.8	13.2	29.0	-	-	-	-	-
1971	55.5	9.2	16.6	29.2	-	-	-	-	-
1972	47.4	4.1	8.7	31.6	-	-	-	-	-
1973	51.4	4.7	9.1	32.5	-	-	39	0.6	15.4
1974	61.0	6.1	10.0	37.7	-	-	45.2	0.5	1.2
1975	74.7	7.5	10.0	44.5	-	-	55.4	0.4	0.7
1976	90.8	7.3	8.0	52.1	-	-	-	-	-
1977	101.8	7.4	7.3	65.4	-	-	-	-	-
1978	117.5	7.7	6.6	81.3	-	-	-	-	-
1979	141.8	13.5	9.5	-	-	-	-	-	-

T.V.C. = Total Variable Cost

C.P. = Cost of Pesticides

Source: Ministry of Agriculture

Table 2-12

Relative Importance of Pesticide Costs in Some Crops
(1965-1979)
'L.E./Feddan

Years	Eggplant			Tomatoes			Potatoes		
	T.V.C.	C.P.	%	T.V.C.	C.P.	%	T.V.C.	C.P.	%
1965	-	-	-	36.2	1.5	4.2	76.0	1.6	2.0
1966	-	-	-	38.9	1.7	4.4	87.9	1.8	2.0
1967	37.9	0.4	1.0	38.4	1.8	4.7	81.2	2.0	2.5
1968	38.4	0.4	1.0	39.2	1.9	4.9	83.2	2.4	2.9
1969	39.1	0.4	1.0	40.7	1.9	4.7	79.6	1.8	2.3
1970	38.3	0.1	0.3	41.3	2.7	6.5	82.7	2.1	2.5
1971	35.7	0.1	0.3	43.4	3.6	8.2	83.2	2.9	3.5
1972	38.2	0.4	1.1	44.4	3.0	6.8	91.9	8.2	8.9
1973	39.1	0.8	2.0	46.9	3.1	6.6	104.1	8.6	8.2
1974	46.4	0.9	1.9	50.2	3.8	7.6	110.6	8.5	7.7
1975	57.4	1.3	2.3	65.9	7.0	10.6	138.0	10.1	7.3
1976	71.8	1.5	2.1	81.6	8.3	10.2	176.5	9.4	5.3
1977	83.9	1.8	2.2	97.6	8.6	8.8	255.9	10.2	4.0
1978	89.5	1.7	1.9	128.0	11.7	9.1	263.6	9.1	3.5
1979	104.9	1.8	1.7	149.7	14.4	9.6	278.3	13.5	4.9

Source: Ministry of Agriculture

T.V.C. = Total Variable Cost

C.P. = Cost of Pesticides

Table 2-13

Costs of Cotton Pesticides in Egypt
(1967-1980)

Years	Area 000 Feddan	Handle Control		Chemical Control		Total
		Value	%	Value	%	
1967	1626	9490	52.77	8493	47.23	17983
1968	1464	7657	52.11	7036	47.89	14693
1969	1622	7990	43.29	10468	56.71	18458
1970	1627	7043	38.94	11043	61.06	18086
1971	1525	6704	33.0	13613	67.0	20317
1972	1552	6265	33.11	12654	66.89	18919
1973	1600	9692	36.49	16871	63.51	26563
1974	1453	13335	40.2	19834	59.8	33169
1975	1346	14648	35	27199	65.0	41847
1976	1248	13814	35.28	25343	64.72	39157
1977	1423	17506	34.7	32949	65.3	50455
1978	1189	18264	35.53	33146	64.47	51410
1979	1196	14937	22.49	51493	77.51	66430
1980		14319	21.21	53192	78.79	67511

Source: The principle Bank of Agricultural Development and Credit

Table 2-14

Estimated Return from Using Pesticides on Cotton

[illegible]	Production 000' Kantar	Losses 30% 000's Kantar	Price/ Kantar LE	Return from Using Pesticides	Cost of Pesticides	Gain, loss LE
6[illegible]	1640	492.	16.12	7931.04	9500.	-1568.96
66	1433	429.9	16.052	6900.75	12827.1	-5926.35
67	1208	362.4	17.042	7176.02	6829.2	- 653.18
68	1210	363.0	17.463	6339.07	6002.4	+ 336.67
69	1479	443.7	18.04	8004.35	9894.2	+1889.85
70	1404	421.2	18.19	7661.63	11063.6	-3401.97
71	1408	422.4	18.24	7704.58	14030.	-6325.42
72	1422	426.5	19.856	8470.57	6363.2	+2107.37
73	1367	410.1	19.51	8001.05	7520.	+ 481.05
74	1204	361.2	23.62	8531.54	8863.3	- 331.76
75	1055	316.5	25.36	8026.44	10095.	+2068.56
76	1084	325.2	32.0	10406.4	9110.4	+1296.
77	1256	376.8	34.39	12958.15	10530.2	+2427.95
78	1189	356.7	34.87	12438.13	9115.3	+3282.83
79	1288	386.4	46.8	18083.52	16146.	+1937.52

[illegible]urce: Collected from Data of:

1. Agri. Economic Research Institute, Agric. Research Center, Ministry of Agriculture.
2. Estimation of losses percentage by 30% if not using pesticide.

Table 2-15

Relative Importance of Cultivated Areas for Rice in Egypt (1965-1979).

(Area 000's F.)

Year	Total cultivated area-Egypt	Total cultivated area-Rice	Percent
1965	10,261	1,191	11.6
1966	10,488	1,204	11.5
1967	10,462	1,075	10.3
1968	10,740	844	7.9
1969	10,732	849	7.9
1970	10,746	1,142	10.6
1971	10,742	1,137	10.6
1972	10,831	1,146	10.6
1973	10,923	997	9.1
1974	11,026	1,053	9.5
1975	11,163	1,053	9.5
1976	11,198	1,079	9.6
1977	11,111	1,040	9.4
1978	11,142	1,031	9.3
1979	11,235	1,040	9.3

<u>Source:</u> Agr. Economic Research Institute, Agr. Research Center, Ministry of Agriculture, 1965-1979.

Table 2-16

Relative Importance of Exports for Rice in Egypt
1965-1979.

(v. 000's L.E.)

Year	Total Exports	Exports of Rice	Percent
1965	263,132	17,890	6.80
1966	263,135	17,901	6.80
1967	246,203	27,462	11.15
1968	270,295	40,513	14.99
1969	323,929	51,683	15.96
1970	331,178	33,898	10.24
1971	343,177	23,499	6.85
1972	358,775	21,448	5.98
1973	444,197	25,804	5.81
1974	593,299	39,657	6.68
1975	548,585	24,100	4.39
1976	595,450	30,724	5.16
1977	668,478	23,250	3.48
1978	679,754	19,882	2.92
1979	1,287,805	22,072	1.71

Source: *Monthly Bulletin of Foreign Trade*, Central Agency for Public Mobilization and Statistics, 1965-1979.

Table 2-17

Area, Yield and Production for Main Crops in Egypt

Area: (000 fed.) Prod.: (000 units)

Crops/ Year	Wheat Area	Wheat Yield	Wheat Prod.	Summer Maize Area	Summer Maize Yield	Summer Maize Prod.	Nile Maize Area	Nile Maize Yield	Nile Maize Prod.	Summer Rice Area	Summer Rice Yield Ton	Summer Rice Prod.	Nile Rice Area	Nile Rice Yield Ton	Nile Rice Prod.
1965	1,144	7.41	8,480	931	12.27	11,420	520	7.45	3,872	842	2.117	1,783	6	0.926	5
1966	1,291	7.57	9,767	1,053	12.32	12,979	522	7.67	4,0_2	841	1.993	1,677	3	0.668	2
1967	1,245	6.91	8,605	1,095	11.44	12,530	390	7.49	2,4_7	1,072	2.124	2,277	3	0.766	2
1968	1,413	7.16	10,120	1,169	11.51	13,456	385	7.67	2,954	1,199	2.153	2,582	5	0.821	4
1969	1,246	7.69	8,457	1,143	12.35	14,127	341	8.13	2,772	1,187	2.151	2,553	5	0.722	3
1970	1,304	7.75	10,109	1,153	12.33	14,211	351	8.23	2,885	1,140	2.283	2,602	3	0.891	2
1971	1,349	8.55	11,529	1,170	12.07	14,132	351	7.39	2,595	1,135	2.231	2,532	2	0.915	2
1972	1,239	8.69	10,772	1,210	12.33	14,924	321	7.30	2,343	1,144	2.191	2,505	2	0.971	2
1973	1,248	9.82	1,246	1,303	11.75	15,314	351	7.38	2,593	995	2.283	2,273	2	0.951	2
1974	1,370	9.17	12,558	1,387	11.40	15,807	368	8.29	3,051	1,051	2.132	2,239	2	1.017	3
1975	1,394	9.72	13,555	1,426	11.56	16,485	404	8.36	3,346	1,047	2.309	2,418	5	0.978	5
1976	1,396	9.36	13,067	1,490	12.24	18,247	401	8.77	3,514	1,074	2.137	2,295	5	1.048	5
1977	1,207	9.37	11,316	1,323	11.85	1,568	442	8.55	3,780	1,037	2.188	2,270	2	1.159	3
1978	1,381	9.33	12,887	1,405	12.75	17,906	494	8.83	4,359	1,025	2.288	2,345	6	0.945	5
1979	1,341	8.90	12,376	1,413	12.00	6,984	472	8.53	4,025	1,037	2.418	2,507	3	1.048	4
1980	1,326	9.08	11,976	1,433	13.17	18,885	473	8.91	4,214	970	2.455	2,382	-	—	-

Table 2-18

Area, Yield and Production for Main Crops
(El Dakahlia)

Area: (000 fed.)

Crops/ Year	Wheat			Summer Maize			Nile Maize			Summer Rice		
	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield Ton	Prod.
1965	130	7.14	931	36	11.74	425	38	8.65	325	244	2.022	493
1966	145	7.56	1,098	55	11.15	613	29	7.88	231	234	1.962	459
1967	146	5.66	825	58	11.42	661	20	7.89	160	281	2.072	582
1968	165	6.85	1,128	69	11.31	781	17	7.13	125	313	2.233	698
1969	149	6.70	996	56	12.20	680	9	8.41	75	303	2.139	649
1970	148	7.33	1,086	57	13.16	753	13	10.53	134	288	2.296	661
1971	149	8.48	1,267	55	12.60	699	27	9.53	255	294	2.120	624
1972	146	8.72	1,275	58	13.30	773	22	10.81	238	296	2.125	629
1973	135	10.10	1,360	70	11.68	820	22	10.90	241	259	2.135	552
1974	149	9.54	1,425	73	11.64	854	28	11.76	327	283	1.936	548
1975	147	10.10	1,485	76	13.00	991	26	10.76	282	282	2.218	625
1976	155	9.57	1,488	71	13.20	942	34	11.00	279	291	2.093	609
1977	126	9.33	1,178	48	12.57	602	37	11.50	429	277	2.142	593
1978	144	9.57	1,379	52	16.38	858	49	11.32	559	284	2.393	679
1979	153	9.29	1,419	57	12.77	734	34	11.28	380	293	2.447	718

Table 2-19

Area, Yield and Production for Main Crops
(Domiatte)

Area: (000 fed.)

Crops/ Year	Wheat			Summer Maize			Nile Maize			Summer Rice		
	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield Ton	Prod.
1965	15	7.26	106	5	7.57	39	4	5.49	22	40	2.268	91
1966	14	7.15	99	8	7.80	59	3	5.66	16	41	2.114	87
1967	15	4.16	63	6	7.60	49	4	3.92	15	53	2.101	111
1968	17	6.41	109	10	8.34	86	3	4.17	14	62	2.184	135
1969	16	6.98	110	8	8.87	68	2	4.92	11	58	2.403	140
1970	15	7.67	117	7	9.68	64	1	6.71	7	59	2.300	137
1971	15	7.86	116	5	8.33	46	2	6.34	15	48	2.441	117
1972	14	7.93	113	6	8.33	47	3	7.10	23	48	2.419	116
1973	14	9.37	127	7	7.87	52	3	7.01	20	44	2.500	111
1974	15	8.69	131	8	9.14	69	8	7.52	63	49	2.363	116
1975	13	8.46	111	7	7.62	53	5	7.02	32	49	2.520	122
1976	13	9.12	123	7	7.42	51	4	7.39	31	51	2.378	122
1977	11	8.73	94	5	8.26	38	6	7.78	43	53	2.330	123
1978	12	9.31	116	7	9.76	64	6	7.80	44	51	2.482	127
1979	12	8.42	102	6	9.38	53	4	7.74	28	52	2.580	133

Table 2-20

Area, Yield and Production for Main Crops
(El Sharkia)

Area: (000 fed.)

Crops/ Year	Wheat			Summer Maize			Nile Maize			Summer Rice		
	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield Ton	Prod.
1965	151	7.40	1,120	151	12.14	1,838	19	5.65	109	135	2.107	285
1966	155	7.43	1,151	155	12.23	1,894	28	6.57	186	132	1.916	252
1967	143	7.06	1,008	164	9.96	1,636	16	7.63	124	172	2.033	350
1968	156	7.15	1,119	166	10.12	1,678	18	7.55	135	185	2.053	381
1969	146	7.19	1,050	174	11.52	2,009	9	8.91	84	186	2.046	380
1970	151	7.79	1,181	175	11.88	2,083	11	9.00	103	180	2.202	396
1971	155	8.95	1,385	195	11.51	2,248	12	7.81	93	195	2.211	432
1972	143	9.13	1,307	181	12.40	2,250	13	8.27	107	196	2.105	413
1973	142	10.01	1,419	194	12.07	2,346	18	8.36	150	173	2.225	385
1974	152	10.78	1,640	225	11.34	2,556	-	-	-	182	2.084	378
1975	163	10.57	1,720	207	11.78	2,434	34	9.61	326	175	2.336	409
1976	173	9.90	1,715	204	10.84	2,212	26	9.61	250	183	2.044	374
1977	144	9.72	1,399	184	10.84	1,993	37	9.26	339	160	2.067	332
1978	163	9.78	1,596	199	12.41	2,473	36	9.89	354	155	2.252	349
1979	169	8.92	1,507	205	12.58	2,579	37	9.98	368	159	2.448	389

Table 2-21

Net Return for Rice Crop in Egypt in the Period 1970-1979

	Main Product			By-Product					
Year	Yield per-F Ton	Farm Price L.E.	Revenue L.E.	Yield per-F Ton	Farm Price L.E.	Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	2.283	28.413	64.87	6.03	0.36	2.17	67.04	36.80	30.24
1971	2.231	27.54	61.44	6.20	0.38	2.36	63.80	36.95	26.85
1972	2.191	26.83	58.78	6.35	0.34	2.16	60.95	36.55	24.39
1973	2.283	28.09	64.13	6.40	0.54	3.46	67.59	38.87	28.72
1974	2.132	36.00	76.72	6.80	0.55	3.74	80.46	45.05	35.41
1975	2.309	40.24	92.91	6.60	0.85	5.61	98.52	55.31	43.21
1976	2.137	50.00	106.85	5.90	0.77	4.54	111.39	68.72	42.67
1977	2.188	50.40	110.28	6.07	1.46	8.86	119.14	73.48	45.66
1978	2.288	66.10	151.24	6.40	1.44	9.29	160.53	81.73	78.80
1979	2.418	65.89	159.32	6.80	1.65	11.22	170.54	101.73	68.81

Source: MOA

Table 2-22

Net Return for Rice Crop-Sharkia Governorate (1970-1979)

Year	Main Product			By-Product			Total Revenue	Total Cost Without Rent	Net Return
	Yield per-F Ton	Farm Price L.E.	Revenue L.E.	Yield per-F Ton	Farm Price L.E.	Revenue L.E.			
1970	2.20	27.66	60.85	6.2	0.5	3.10	63.95	36.97	26.98
1971	2.21	26.57	58.72	6.2	0.5	3.10	61.82	37.84	23.98
1992	2.11	27.17	57.33	6.6	0.33	2.18	59.51	37.68	21.83
1973	2.22	28.00	62.16	6.6	0.55	3.83	65.79	40.96	24.83
1974	2.084	35.12	73.19	6.52	0.55	3.59	76.78	54.41	22.37
1975	2.336	40.16	93.81	6.52	0.60	3.91	97.72	61.92	35.80
1976	2.044	49.79	101.77	6.07	0.70	4.25	106.02	75.11	30.91
1977	2.067	55.17	114.04	6.10	1.87	11.41	125.45	80.26	45.19
1978	2.252	65.00	146.38	6.18	1.60	9.89	156.27	82.29	73.98
1979	2.448	67.00	164.02	6.00	1.70	10.20	174.22	102.29	71.93

Table 2-23

Net Return for Rice Crop-Dakahlia Governorate (1970-1979)

Year	Main Product			By-Product			Total Revenue	Total Cost Without Rent	Net Return
	Yield per-F Ton	Farm Price L.E.	Revenue L.E.	Yield per-F Ton	Farm Price L.E.	Revenue L.E.			
1970	2.30	27.07	62.26	6.5	0.35	2.28	64.54	37.88	26.66
1971	2.12	27.09	57.43	6.75	0.35	0.36	59.79	37.93	21.86
1972	2.13	27.17	57.87	7.00	0.35	2.45	2.45	60.32	23.81
1973	2.13	28.20	60.07	7.00	0.56	3.92	63.99	37.60	26.39
1974	1.94	34.84	67.45	7.25	0.50	3.63	71.08	42.24	28.84
1975	2.22	40.02	88.76	7.30	1.00	7.30	96.06	49.42	46.64
1976	2.09	49.58	103.77	6.75	0.75	5.06	108.83	69.21	39.62
1977	2.14	59.39	127.21	7.00	1.25	8.75	135.96	71.85	58.11
1978	2.39	63.00	150.63	7.50	1.50	11.25	161.88	77.39	84.49
1979	2.45	66.16	161.89	7.90	2.00	15.80	177.69	87.07	90.82

Table 2-24

Net Return for Rice Crop-Domiatte Governorate (1970-1979)

Year	Main Product			By-Product			Total Revenue	Total Cost Without Rent	Net Return
	Yield per-F Ton	Farm Price L.E.	Revenue L.E.	Yield per-F Ton	Farm Price L.E.	Revenue L.E.			
1970	2.30	26.72	61.46	5.33	0.40	2.13	63.59	38.53	25.06
1971	2.44	26.91	65.66	6.33	0.40	2.53	68.19	39.12	29.07
1972	2.42	26.10	63.16	6.00	0.43	2.58	65.74	39.11	26.63
1973	2.50	28.26	127.17	5.66	0.50	2.83	130.00	45.70	84.30
1974	2.363	34.43	81.36	7.33	0.55	4.03	85.39	50.67	34.72
1975	2.520	39.59	99.77	7.00	0.50	3.50	103.27	59.30	43.97
1976	2.378	50.08	119.09	5.00	0.75	3.75	122.84	68.05	54.79
1977	2.33	58.27	135.77	5.40	1.25	6.75	142.52	74.16	68.36
1978	2.482	64.76	160.73	6.33	1.50	9.50	170.23	84.54	85.69
1979	2.58	68.13	175.78	7.50	1.66	12.45	188.23	107.75	80.48

Source: AERI, Agr. Research Center, 1970-1979.

Table 2-25

Average Input Costs per Feddan for Rice, 1965-79, all Egypt

Year	Labor	Percent	Animals	Percent	Seeds	Percent	Organic	Percent	Chemical	Percent	Mechanical	Percent	Insecticides	Percent	Others	Percent	Total
1965	13.2	41.0	8.0	24.8	3.4	10.6	2.8	8.7	4.2	13.0	--	--	--	--	0.6	1.9	32.2
1966	14.5	40.7	8.6	24.2	3.9	11.0	3.0	8.4	5.1	14.3	--	--	--	--	0.5	1.4	35.6
1967	14.5	40.4	8.2	22.8	4.2	11.7	2.9	8.1	5.0	13.9	0.6	1.7	--	--	0.5	1.4	35.9
1968	15.1	40.0	8.7	23.0	4.5	11.9	3.0	7.9	5.4	14.3	0.6	1.6	--	--	0.5	1.3	37.8
1969	14.6	39.3	2.9	7.8	4.7	12.6	3.0	8.1	5.4	14.5	6.2	16.7	--	--	0.4	1.0	37.2
1970	12.8	39.3	2.9	7.8	4.7	12.6	3.0	8.1	5.4	14.5	6.2	16.7	--	--	0.6	1.6	36.9
1971	12.6	34.2	4.5	12.2	4.3	11.7	2.8	7.6	5.7	15.5	6.8	18.4	--	--	0.6	1.6	36.9
1972	12.2	33.4	4.2	11.5	3.9	10.7	2.8	7.7	5.5	15.0	7.4	20.3	--	--	0.5	1.4	36.5
1973	13.3	34.1	4.2	10.8	4.4	11.4	2.7	6.9	6.0	15.4	7.4	19.0	0.6	15.4	0.4	1.0	39.0
1974	16.3	36.1	4.1	9.1	4.9	10.8	3.2	7.1	5.5	12.2	8.8	19.5	0.5	1.2	0.9	2.0	45.2
1975	22.0	37.9	5.1	9.2	5.2	9.3	4.2	7.6	6.1	11.0	10.4	18.8	0.4	0.7	2.0	3.6	55.4
1976	29.3	42.7	7.7	11.2	5.5	8.0	4.9	7.1	6.5	9.5	12.5	18.2	--	--	2.2	3.2	68.6
1977	33.9	46.1	7.8	10.6	5.1	6.9	5.1	6.9	6.4	8.7	13.2	17.9	--	--	2.1	2.9	73.6
1978	34.7	42.5	8.7	10.7	6.8	8.2	6.3	7.7	7.5	9.2	15.4	18.9	--	--	2.3	2.8	81.7
1979	48.1	47.3	8.3	8.2	9.4	9.2	6.6	6.5	8.3	8.2	17.4	17.1	--	--	3.6	3.5	101.7

Table 2-26

Average Input Costs per Feddan for Rice, Sharkia Governorate

Year	Labor	Percent	Animals	Percent	Seeds	Percent	Organic	Percent	Chemical	Percent	Mechanical	Percent	Insecticides	Percent	Others	Percent	Total
1965	14.4	48.2	8.0	26.8	2.8	9.4	0.4	1.3	3.9	13.0	--	--	--	--	0.4	1.3	29.9
1966	14.5	42.5	8.3	24.3	4.0	11.7	2.5	7.3	4.3	12.6	--	--	--	--	0.5	1.6	34.1
1967	15.1	43.0	8.5	24.2	4.2	12.0	2.5	7.1	4.3	12.3	--	--	--	--	0.5	1.4	35.1
1968	15.9	43.0	8.0	21.7	4.2	11.4	2.5	6.8	5.8	15.7	--	--	--	--	0.5	1.4	36.9
1969	14.9	39.2	3.9	10.3	4.5	11.8	2.5	6.6	5.7	15.0	6.0	15.8	--	--	0.5	1.3	38.0
1970	14.3	38.7	3.6	9.7	4.5	12.0	2.5	6.8	5.7	15.4	5.9	16.0	--	--	0.5	1.4	37.0
1971	13.5	35.7	4.5	11.9	4.4	11.6	2.5	6.6	5.7	15.1	6.8	18.0	--	--	0.4	1.1	37.8
1972	14.2	37.7	4.4	11.7	4.2	11.1	2.5	6.6	5.9	15.7	6.5	17.2	--	--	--	--	37.7
1973	14.8	36.2	4.5	11.0	3.9	9.5	1.8	4.4	7.3	17.9	8.2	20.0	0.4	1.0	--	--	40.9
1974	20.2	37.2	5.0	9.2	5.1	9.4	4.5	8.3	7.6	14.0	10.9	20.1	--	--	1.0	1.8	54.3
1975	26.0	41.8	5.8	9.4	5.9	7.9	4.0	6.5	7.0	11.3	10.9	17.6	0.4	0.7	2.0	3.2	62.0
1976	32.1	42.8	8.9	11.8	5.9	7.9	7.3	9.7	7.6	10.2	11.2	14.9	--	--	2.0	2.7	75.0
1977	35.4	44.0	11.0	13.7	4.5	5.6	7.7	9.6	7.6	9.4	12.3	15.2	--	--	2.0	2.5	80.5
1978	35.7	43.4	9.5	11.5	7.2	8.8	10.0	12.1	6.9	8.3	11.1	13.5	--	--	2.0	2.4	82.3
1979	52.5	50.3	9.0	8.8	7.4	7.2	6.1	6.1	8.6	8.4	15.6	15.3	--	--	4.0	3.9	102.3

Table 2-27

Average Input Costs per Feddan for Rice, Dakahlia Governorate

Year	Labor	Percent	Animals	Percent	Seeds	Percent	Organic	Percent	Chemical	Percent	Mechanical	Percent	Insecticides	Percent	Others	Percent	Total
1965	14.0	39.9	8.8	25.1	3.1	8.8	4.5	12.8	4.2	12.0	--	--	--	--	0.5	1.4	35.1
1966	15.0	41.2	8.9	24.5	3.2	8.8	3.0	8.2	5.8	15.9	--	--	--	--	0.5	1.4	36.4
1967	15.3	41.7	8.9	24.3	3.2	8.7	3.0	8.1	5.8	15.8	--	--	--	--	0.5	1.4	36.7
1968	16.2	42.3	9.4	24.5	3.4	8.9	3.0	7.8	5.8	15.2	--	--	--	--	0.5	1.3	38.3
1969	14.9	37.4	2.4	6.1	4.7	11.8	3.0	7.5	5.8	14.6	9.0	22.6	--	--	--	--	39.8
1970	11.9	31.6	3.7	9.8	4.7	12.4	3.0	7.9	5.8	15.3	8.2	21.7	--	--	0.5	1.3	37.8
1971	11.9	31.4	3.4	9.0	4.5	11.9	3.0	7.9	5.8	15.3	8.8	23.2	--	--	0.5	1.3	37.9
1972	10.5	28.7	4.2	11.5	4.1	11.2	3.0	8.2	5.8	15.9	8.5	23.1	--	--	0.5	1.4	36.6
1973	12.5	33.2	4.2	11.1	4.2	11.1	3.0	8.0	6.0	16.0	6.8	18.0	0.5	1.3	0.5	1.3	37.7
1974	14.0	33.1	3.5	8.3	4.3	10.2	--	--	6.0	14.2	9.7	22.9	1.0	2.4	0.8	1.9	42.3
1975	18.1	36.6	3.0	6.1	4.6	9.3	4.0	8.1	6.0	12.2	11.7	23.7	--	--	2.0	4.1	49.4
1976	28.2	40.8	6.9	10.0	5.7	8.2	5.0	7.1	7.6	11.0	14.5	21.0	--	--	1.3	1.9	69.2
1977	31.1	43.3	7.9	11.0	5.6	7.8	5.8	8.0	6.2	8.6	13.3	18.5	--	--	2.0	2.8	71.9
1978	32.7	42.2	7.5	9.7	7.0	9.0	5.2	6.7	7.8	10.2	15.1	19.5	--	--	2.2	2.8	77.5
1979	38.2	43.8	6.7	7.7	8.2	9.4	7.0	8.0	7.9	9.1	17.0	19.5	--	--	2.2	2.5	87.2

Table 2-28

Average Input Costs per Feddan for Rice, Domiatte Governorate

Year	Labor	Percent	Animals	Percent	Seeds	Percent	Organic	Percent	Chemical	Percent	Mechanical	Percent	Insecticides	Percent	Others	Percent	Total
1965	11.4	37.8	9.2	30.6	4.2	14.0	2.0	6.6	2.8	9.3	--	--	--	--	0.5	1.7	30.1
1966	12.9	39.7	9.6	29.5	4.1	12.6	2.5	7.7	2.9	8.9	--	--	--	--	0.5	1.6	32.5
1967	13.1	38.4	8.9	26.0	4.2	12.3	2.5	7.3	2.9	8.5	2.0	5.9	--	--	0.5	1.5	34.1
1968	13.6	36.0	9.9	26.3	4.3	11.4	3.0	8.0	4.4	11.7	2.0	5.3	--	--	0.5	1.3	37.7
1969	14.0	36.6	2.2	5.7	4.2	11.0	3.0	7.8	4.4	11.5	9.5	24.8	--	--	1.0	2.6	38.3
1970	14.0	36.2	2.2	5.7	4.2	10.9	3.0	7.8	4.4	11.4	9.8	25.4	--	--	1.0	2.6	38.6
1971	15.0	38.2	2.2	5.6	4.2	10.7	3.0	7.7	4.4	11.2	9.4	24.0	--	--	1.0	2.6	39.2
1972	15.3	39.0	2.0	5.1	4.2	10.7	3.0	7.7	4.4	11.2	9.3	23.7	--	--	1.0	2.6	39.2
1973	18.0	39.3	3.3	7.2	5.6	12.2	3.0	6.6	6.0	13.1	8.9	19.4	--	--	1.0	2.2	45.8
1974	21.3	42.0	3.7	7.3	5.6	11.2	3.0	5.9	7.0	13.8	9.0	17.8	--	--	1.0	2.0	50.7
1975	26.4	44.5	3.7	6.2	5.6	9.4	4.5	7.6	6.0	10.1	11.1	18.7	--	--	2.0	3.4	59.3
1976	30.6	44.9	5.3	7.8	5.8	8.5	4.5	6.6	7.4	10.9	12.5	18.4	--	--	2.0	2.9	68.1
1977	31.4	42.3	6.8	9.2	5.8	7.8	4.6	6.2	7.6	10.2	16.0	21.6	--	--	2.0	2.7	74.2
1978	31.8	37.6	6.5	7.7	8.3	9.8	7.0	8.2	8.7	10.3	20.3	24.0	--	--	2.0	2.4	84.6
1979	45.5	42.2	12.1	11.2	10.0	9.3	14.0	13.0	8.7	8.1	15.5	14.4	--	--	2.0	1.9	107.8

Table 2-29

Area, Yield and Production for "Cotton"
(Egypt)

Area: (1,000 feddan)

Production: (000 Quantar)

Year	Area	Yield	Production
1965	1,900	5.02	9,533
1966	1,859	4.40	8,185
1967	1,626	4.72	7,670
1968	1,464	5.25	7,684
1969	1,622	5.79	9,394
1970	1,627	5.48	8,914
1971	1,525	5.90	9,004
1972	1,552	5.82	9,028
1973	1,600	5.43	8,683
1974	1,453	5.26	7,646
1975	1,346	4.98	6,702
1976	1,248	5.52	6,884
1977	1,423	4.90	6,978
1978	1,189	6.35	7,547
1979	1,196	6.84	8,177
1980			

Table 2-30

Area, Yield and Production for "Cotton"
El Dakahlia

Area: (1,000 feddan)

Production: (000 Quantar)

Year	Area	Yield	Production
1965	268	4.63	1,241
1966	264	3.41	899
1967	237	4.05	961
1968	200	5.05	1,012
1969	229	5.68	1,300
1970	239	5.62	1,345
1971	225	5.42	1,220
1972	229	5.22	1,196
1973	239	4.99	1,193
1974	207	5.26	1,091
1975	203	5.00	1,016
1976	189	5.63	1,066
1977	226	5.23	1,182
1978	186	6.46	1,199
1979	187	7.04	1,314
1980			

Table 2-31

Area, Yield and Production for "Cotton" Domiatte

Area: (1,000 feddan)

Production: (000 Quantar)

Year	Area	Yield	Production
1965	28	3.19	89
1966	29	2.17	63
1967	18	3,33	60
1968	8	4.34	35
1969	12	5.02	59
1970	17	5.09	86
1971	22	4.48	98
1972	23	4.54	106
1973	25	4.54	112
1974	18	4.34	77
1975	18	4.11	76
1976	18	4.74	83
1977	20	3.90	78
1978	14	4.44	63
1979	16	6.03	96
1980			

Table 2-32

Area, Yield and Production for "Cotton"
El Sharkia

Area: (1,000 feddan)

Production: (000 Quantar)

Year	Area	Yield	Production
1965	197	5.08	1,003
1966	207	3.85	796
1967	177	5.18	915
1968	173	6.08	1,054
1969	193	7.19	1,386
1970	194	6.26	1,216
1971	170	5.87	998
1972	182	5.26	956
1973	172	5.60	964
1974	164	4.78	786
1975	138	5.54	714
1976	132	5.30	701
1977	161	5.54	893
1978	143	6.78	970
1979	137	7.71	1,056
1980			

Table 2-33

Relative Importance of Cotton Exports in the period 1965-1979.

(Value 000's L.E.)

Year	Total Export	Cotton Export	Percent
1965	263,132	146,214	55.57
1966	263,135	143,396	54.50
1967	246,203	121,562	49.37
1968	270,295	120,080	44.43
1969	323,929	130,728	40.36
1970	331,178	147,869	44.65
1971	343,177	174,985	50.99
1972	358,775	161,959	45.14
1973	444,197	191,937	43.21
1974	593,299	279,100	47.04
1975	548,585	201,033	36.65
1976	595,450	154,752	25.99
1977	668,478	182,268	27.27
1978	679,754	131,523	19.35
1979	12,787,805	267,277	20.75

Source: Monthly Bulletin of Foreign Trade, Center Agency of Public Mobilization and Statistics, 1965-1979.

Table 2-34

Equations of Secular Trend of Cultivated Areas for Cotton in the period 1965-1979.

	Equation	Significant level 0.05	The year rate of change Percent	R^{-2}
Sharkia	$Y_i = 205.69 - 4.54 X_i$ (0.75)	Significant	-21.4	0.72
Dakahlia	$Y_i = 258.17 - 4.52 X_i$ (1.02)	Significant	-16.3	0.57
Domiatte	$Y_i = 21.88 - 0.36 X_i$ (0.34)	Significant	-15.1	0.78
Egypt	$Y_i = 1849.72 - 42.63 X_i$ (5.89)	Significant	-21.1	0.78

Where: Y_i = estimated value of cultivated areas (000's F.) on observation

X_i = time, $i=1,2,3,\ldots,15$

Table 2-35

Equations of Secular Trend of Yield for Cotton in the period 1965-1979

	Equation	Sign. level 0.05	R^{-2}	The yearly rate of change (%)
Sharkia	$Y_i = 4.98 + 0.09\ X_i$ (0.05)	non-sign.	0.13	12.6
Dakahlia	$Y_i = 4.1 + 0.14\ X_i$	sign	0.52	21.3
Domiatte	$Y_i = 3.32 + 0.12\ X$ (.39)	sign	0.31	22.4
Egypt	$Y_i = 4.78 + 0.08\ X_i$	sign	0.29	11.0

where: Y_i = estimated value of yield for cotton Feddan Ton on's observation$_i$

X_i = Time, i=1,2,3,....,15

Table 2-36

Equations of Secular Trends of Total Production for Cotton in the period 1965-1979

	Equation	Sign. level 0.05	R^{-2}	The yearly rate of change (%)
Sharkia	$Y_i = 1046.6 - 10.77\ X_i$ (10.77)	non-sign		-8.9
Dakahlia	$Y_i = 1084.8 + 8.03\ X_i$ (8.06)	non-sign		5.6
Domiatte	$Y_i = 65.8 + 1.47\ X_i$ (1.2)	non-sign		15.2
Egypt	$Y_i = 9018.5 - 110.4\ X_i$	sign		-9.8

Where Y_i = estimated value of total production (00's ton) on observation_i
X_i = time, $i = 1,2,\ldots\ldots,15$

Table 2-37

Net Return for Cotton Egypt in the Period
1970-1979

Year	Main Product			By-Product			Total Revenue	Total Cost Without Rent	Net Return
	Yield per-F KM	Farm Price L.E.	Revenue L.E.	Yield per-F	Farm Price L.E.	Revenue L.E.			
1970	5.48	18.19	99.68	5.74	0.56	3.21	102.89	51.54	51.35
1971	4.90	18.24	107.62	5.63	0.52	2.93	110.55	55.41	55.14
1972	5.82	19.86	115.56	5.80	0.66	3.83	119.39	47.41	71.98
1973	5.43	19.51	105.94	5.84	0.80	4.67	110.61	51.23	59.38
1974	5.26	23.62	124.24	5.69	0.90	5.12	129.36	60.88	68.48
1975	4.98	25.36	126.29	5.60	1.11	6.22	132.51	74.66	57.85
1976	5.52	32.00	176.64	5.50	1.24	6.82	183.46	90.80	92.66
1977	4.90	34.39	168.51	5.57	1.81	10.08	178.59	101.76	76.83
1978	6.35	34.87	221.42	6.00	1.82	10.92	232.34	117.41	114.93
1979	6.84	46.80	320.11	6.20	2.25	13.95	334.06	141.75	192.31

Table 2-38

Net Return for Cotton Sharkia Governorate
(1970-1979)

Year	Main Product Yield per-F KM	Main Product Farm Price L.E.	Main Product Revenue L.E.	By-Product Yield per-F	By-Product Farm Price L.E.	By-Product Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	6.26	17.06	106.80	5.0	0.8	4.00	110.80	56.74	54.06
1971	5.87	16.80	98.62	5.0	0.8	4.00	102.62	68.20	34.42
1972	5.26	18.30	96.26	4.9	0.9	4.41	100.67	52.93	47.74
1973	5.60	18.01	100.86	5.25	1.0	5.25	106.11	57.07	49.04
1974	4.78	22.11	105.69	5.34	1.0	5.34	111.03	65.35	45.68
1975	5.54	23.92	132.52	6.27	1.44	9.03	141.55	82.69	58.86
1976	5.30	32.77	173.68	6.18	1.44	8.90	182.58	102.95	79.63
1977	5.54	35.74	198.00	4.50	2.58	11.61	209.61	105.37	104.24
1978	6.78	36.24	245.71	4.65	2.00	9.30	255.01	119.69	135.32
1979	7.71	48.45	373.55	5.30	2.50	13.25	386.80	132.95	253.85

Table 2-39

Net Return for Cotton Dakahlia Governorate
(1970-1079)

Year	Main Product Yield per-F KM	Main Product Farm Price L.E.	Main Product Revenue L.E.	By-Product Yield per-F	By-Product Farm Price L.E.	By-Product Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	5.62	20.25	113.81	6.5	0.50	3.25	117.06	53.48	63.58
1971	5.42	20.65	111.92	6.5	0.80	3.90	115.82	57.48	58.34
1972	5.22	21.89	114.27	6.0	0.50	3.00	117.27	46.28	70.99
1973	4.99	21.11	105.34	6.0	0.60	3.60	108.94	48.38	60.56
1974	5.26	25.50	134.13	6.0	0.75	4.50	138.63	59.76	78.87
1975	5.00	27.83	139.15	6.0	1.25	7.50	146.65	67.65	79.00
1976	5.63	33.84	190.52	6.0	1.75	10.50	201.02	89.27	41.75
1977	5.23	36.11	188.86	6.0	2.00	12.00	200.86	102.60	98.26
1978	6.46	36.17	233.66	6.0	2.00	14.00	247.66	107.16	140.50
1979	7.04	48.02	338.06	7.5	2.25	16.88	354.94	131.15	223.79

Table 2-40

Net Return for Cotton Domiatte Governorate
(1970-1079)

	Main Product			By-Product					
Year	Yield per-F KM	Farm Price L.E.	Revenue L.E.	Yield per-F	Farm Price L.E.	Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	5.09	20.61	104.90	5.33	0.50	2.67	107.57	43.77	63.80
1971	4.48	20.97	93.95	5.00	0.40	2.00	95.95	50.11	45.84
1972	4.54	22.72	103.15	5.00	0.43	2.15	105.30	45.12	60.18
1973	4.54	21.90	99.43	5.00	0.50	2.50	101.93	47.07	54.86
1974	4.34	25.12	109.02	5.66	1.25	7.08	116.10	55.36	60.72
1975	4.11	27.71	113.89	4.33	1.23	5.23	119.22	70.03	49.19
1976	4.74	33.36	158.13	4.50	1.20	5.40	163.53	80.98	82.55
1977	3.90	36.95	144.11	4.70	1.52	7.14	151.25	106.31	44.94
1978	4.44	37.19	165.12	4.50	1.52	6.84	171.96	113.76	56.20
1979	6.03	47.71	287.69	5.60	2.60	14.56	302.22	127.55	174.70

Source: AERI, Agr. Research Center, 1970-1979.

Table 2.41

The Farm Price for Cotton in Egypt and East Delta during (1965 - 1979)

	Egypt		Sharkia		Dakahlia		Domiatte	
Years	Value	I	Value	I	Value	I	Value	I
1965	16.12	100	15.377	100	17.4	100	17.953	100
1966	16.052	99.58	15.492	100.75	17.615	101.24	17.382	96.82
1967	17.042	105.72	17.687	115.02	17.881	102.76	17.451	97.2
1968	17.463	108.33	17.84	116.02	18.823	108.18	18.87	105,11
1968	18.04	111.91	17.65	117.78	20.21	116.15	19.87	110.68
1970	18.19	112.84	17.06	110.94	20.25	116.38	20.61	114.8
1971	18.24	113.15	16.8	109.25	20.65	118.68	20.97	116.8
1972	19.856	123.18	18.3	119.01	21.89	125.8	22.72	126.55
1973	19.51	121.03	18.01	117.12	21.11	121.32	21.9	121.99
1974	23.62	146.53	22.11	143.79	25.5	146.24	25.12	139,92
1975	25.36	157.32	23.92	155.56	27.83	159.94	27.71	154.35
1976	32	198.51	32.77	213.11	33.89	194.48	33.36	185.82
1977	34.39	213.34	35.74	232.43	36.11	207.53	36.95	205.82
1978	34.89	216.32	36.24	235.68	36.17	207.87	37.19	207.15
1979	46.8	290.32	48.54	315.67	48.02	275.98	47.71	265.75
1980								

Value: L.E.
I: Index Number
L.E. = Quantar

Table 2-42

Cultivated Area, Yield, Total Production for Wheat in Egypt

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	1,144,407	7.41	8,480,056
1966	1,290,575	7.57	9,766,720
1967	1,245,351	6.91	8,664,555
1968	1,412,892	7.16	10,119,726
1969	1,246,384	7.69	8,457,274
1970	1,304,430	7.75	10,109,333
1971	1,349,050	8.55	11,528,839
1972	1,239,335	8.69	10,772,340
1973	1,247,578	9.82	12,464,260
1974	1,369,939	9.17	12,557,661
1975	1,393,950	9.72	13,555,099
1976	1,395,588	9.36	13,066,636
1977	1,207,151	9.37	11,315,865
1978	1,380,612	9.33	12,887,152
1979	1,391,324	8.9	12,375,835
1980	1,326,179	9.03	11,976,243

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

Table 2-43

Cultivated Area, Yield, Total Production for Wheat in Dakahlia

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	130,420	7.14	931,199
1966	145,268	7.56	1,098,294
1967	145,808	5.66	825,405
1968	164,615	6.85	1,128,355
1969	148,757	6.7	995,930
1970	148,108	7.33	1,086,353
1971	149,480	8.48	1,267,031
1972	146,166	8.72	1,275,159
1973	134,663	10.1	1,360,401
1974	149,406	9.54	1,424,620
1975	147,036	10.1	1,485,304
1976	155,392	9.57	1,487,767
1977	126,273	9.33	1,177,773
1978	144,157	9.57	1,379,156
1979	152,866	9.29	1,419,471

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

Table 2-44

Cultivated Area, Yield, Total Production for Wheat in Domiatte

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	14,572	7.26	105,793
1966	13,837	7.15	98,986
1967	15,043	4.16	62,570
1968	17,009	6.41	108,995
1969	15,759	6.98	109,952
1970	15,196	7.67	116,617
1971	14,819	7.86	116,496
1972	14,211	7.93	112,674
1973	13,584	9.37	127,262
1974	15,087	8.69	131,032
1975	13,153	8.46	111,227
1976	13,461	9.12	122,762
1977	10,725	8.73	93,640
1978	12,489	9.31	116,325
1979	12,094	8.42	101,849

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

Table 2-45

Cultivated Area, Yield, Total Production
for Wheat in Sharkia

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	151,408	7.4	1,120,419
1966	155,003	7.43	1,151,470
1967	142,647	7.06	1,007,674
1968	256,395	7.15	1,118,770
1969	146,058	7.19	1,049,697
1970	151,494	7.79	1,049,697
1971	154,661	8.95	1,180,868
1972	143,134	9.13	1,384,814
1973	141,763	10.01	1,307,482
1974	152,144	10.78	1,418,933
1975	162,723	10.57	1,640,068
1976	173,309	9.9	1,719,888
1977	143,915	9.72	1,399,268
1978	163,219	9.78	1,596,060
1979	168,971	8.92	1,507.427

Table 2-46

Net Return Per Feddan of Wheat in Egypt

Year	Main Product			By-Product			Total Revenue	Total Cost Without Rent	Net Return
	Yield per-F KM	Farm Price L.E.	Revenue L.E.	Yield per-F	Farm Price L.E.	Revenue L.E.			
1970	7.75	5.8	44.95	7.19	2	14.38	59.33	39.94	19.52
1971	8.55	5.31	45.4	7.63	1.66	12.67	58.07	39.97	18.08
1972	8.68	5.26	45.71	7.7	1.83	14.09	59.8	40.96	18.84
1973	9.82	5.72	56.17	7.73	2.34	18.09	74.26	42.22	32.07
1974	9.17	7.04	64.56	7.74	3.73	28.87	93.43	47.55	45.94
1975	9.72	7.7	74.84	8.05	3.42	27.53	102.37	48.37	43.04
1976	9.36	7.07	66.18	8.55	3	25.65	91.83	65.17	26.59
1977	9.37	8.12	76.08	8.33	6.05	50.4	126.48	75.85	50.68
1978	9.33	9.25	68.3	8.22	9.3	76.45	162.75	88.44	74.3
1979	8.9	9.6	85.44	8.16	7.5	61.2	146.64	97.71	38.3

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

R = Return

T.R. = Total Return

T.C. = Total Cost

Table 2-47

Net Return Per Feddan of Wheat in Dakahlia

	Main Product			By-Product					
Year	Yield per-F KM	Farm Price L.E.	Revenue L.E.	Yield per-F	Farm Price L.E.	Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	7.33	5.65	41.41	8	2	16	57.41	39.8	17.65
1971	8.48	5.31	45.03	9	2	18	63.03	41.2	21.81
1972	8.72	5.04	43.95	9.5	1.5	14.25	58.2	40.1	18.15
1973	10.1	5.55	56.06	9.29	2	18.58	74.64	40.7	33.99
1974	9.54	6.54	62.39	9.3	3.35	31.16	93.55	44	49.66
1975	10.1	7.55	76.26	9.64	3	28.92	105.18	60.2	45.06
1976	9.57	6.68	63.93	11.08	2.5	27.7	91.63	68.4	23.38
1977	9.33	7.52	70.16	11	6	66	136.16	76.6	59.47
1978	9.57	8.01	76.66	11	8	88	164.66	86.7	77.94
1979	9.29	8.84	82.12	11	7.9	86.9	169.02	104.4	64.68

Table 2-48

Net Return Per Feddan of Wheat in Domiatte

Year	Main Product: Yield per-F KM	Main Product: Farm Price L.E.	Main Product: Revenue L.E.	By-Product: Yield per-F	By-Product: Farm Price L.E.	By-Product: Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	7.67	5.45	41.8	7.33	1.8	13.19	54.99	363.2	18.88
1971	7.86	5	39.3	7.67	1.5	11.51	50.81	36.4	14.49
1972	7.93	5.1	40.44	7.35	1.5	11.03	51.47	36	15.57
1973	9.37	5.1	47.79	8	2.5	20	67.79	36.1	31.7
1974	8.69	6.72	58.4	7.83	3.7	28.97	87.37	40.1	47.35
1975	8.46	7.45	63.03	8.33	3.11	25.91	88.94	45.1	43.92
1976	9.12	6.72	61.29	8	2.4	19.2	80.49	51.5	29.07
1977	8.73	7.78	67.92	7.6	6.66	50.62	118.54	60.8	47.73
1978	9.31	8.8	81.93	7.5	9.5	71.25	153.18	75	78.14
1979	8.42	8.85	74.52	7.75	6.88	53.32	127.84	80.3	47.54

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

R = Return

T.R. = Total Return

T.C. = Total Cost

Table 2-49

Net Return Per Feddan of Wheat in Sharkia

Year	Main Product			By-Product			Total Revenue	Total Cost Without Rent	Net Return
	Yield per-F KM	Farm Price L.E.	Revenue L.E.	Yield per-F	Farm Price L.E.	Revenue L.E.			
1970	7.79	6.25	48.69	7.3	2	14.6	63.29	37.4	25.93
1971	8.95	4.73	42.33	7.9	2	15.8	58.13	41.8	16.35
1972	9.13	5	45.65	8.1	1.5	12.15	57.8	43.1	14.75
1973	10.01	5.25	52.55	8.6	2.52	21.67	74.22	43.8	30.57
1974	10.78	6.62	71.36	8.35	3.8	31.73	103.09	58.4	44.77
1975	10.57	7.5	79.28	8.55	3.37	28.81	108.09	59.3	48.75
1976	9.9	7.35	72.77	8.98	8.8	24.98	97.75	64.7	33.18
1977	9.72	7.93	77.08	8	5	40	117.08	86.3	30.85
1978	9.78	9.17	89.68	8	8	64	153.68	97.4	56.33
1979	8.92	10	89.2	8	5.55	44.4	133.6	107.5	56.10

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

R = Return

T.R. = Total Return

T.C. = Total Cost

Table 2-50

Relative Importance of Inputs for Wheat Per Feddan in Egypt

Years	Value of T. inputs	Animal		Seeds		Manure		Chemical Fertilizer		Mechanical Power		Others	
		Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
1965	15.999	6.387	39.92	2.786	17.41	1.346	8.41	4.282	26.76	0.663	4.14	0.535	3.39
1966	17.082	6.329	37.02	2.935	17.18	1.379	8.07	5.484	32.1	0.374	2.18	0.581	3.4
1967	17.74	6.67	37.59	3.08	17.36	1.39	7.83	5.39	30.38	0.62	3.49	0.59	3.32
1968	17.69	6.78	38.43	3.13	17.74	1.04	5.89	5.52	31.29	0.56	3.17	0.66	3.74
1969	17.39	4.25	24.44	3.05	17.54	0.95	5.46	5.55	31.15	2.91	16.73	0.68	3.91
1970	17.61	3.58	20.33	3.06	17.38	0.88	4.99	5.69	32.32	3.69	20.95	0.71	4.03
1971	17.81	3.81	21.39	3.10	17.41	0.99	5.56	5.79	32.51	3.4	19.09	0.72	4.04
1972	18.82	4.07	21.63	3.2	17.0	0.83	4.41	6.06	32.2	3.92	20.83	0.74	3.93
1973	19.43	3.65	18.79	3.19	16.42	0.93	4.79	6.48	33.35	4.49	23.11	0.69	3.55
1974	22.97	4.06	17.68	3.64	15.85	0.77	3.35	8.31	36.18	5.13	22.33	1.06	4.61
1975	29.01	3.47	11.96	4.71	16.24	2.55	8.79	7.12	24.54	9.62	33.16	1.54	5.31
1976	32.06	3.80	11.85	4.62	14.4	2.29	7.14	8.02	25.02	11.79	36.77	1.54	4.8
1977	35.41	4.78	13.5	4.66	13.16	3.24	9.15	8.65	24.43	12.3	34.74	1.78	5.03
1978	41.06	5.7	13.91	5.40	13.15	3.84	9.35	9.11	22.19	13.83	33.68	3.17	7.72
1979	46.94	8.11	17.28	5.44	11.59	4.09	8.71	9.48	20.2	16.09	34.28	3.73	7.95

Table 2-51

Relative Importance of Inputs for Wheat Per Feddan in Sharkia Governorate

Years	Value of T. inputs	Animal		Seeds		Manure		Chemical Fertilizer		Mechanical Power		Others	
		Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
1965	16.15	6.4	39.63	3.0	18.58	2.5	15.48	3.75	23.22	--	--	0.5	3.1
1966	17.4	6.2	35.63	3.0	17.24	2.5	14.37	5.2	29.89	--	--	0.5	2.87
1967	17.3	5.6	32.37	3.0	17.34	3.0	17.34	5.2	30.06	--	--	0.5	2.89
1968	16.9	6.2	36.69	3.0	17.75	2.0	11.83	5.2	30.77	--	--	0.5	2.96
1969	16.1	3.0	18.63	3.0	18.63	2.0	12.42	5.2	32.30	2.4	14.91	0.5	3.11
1970	16.4	2.1	12.80	3.0	18.29	2.0	12.2	5.2	31.71	3.6	21.95	0.5	3.05
1971	18.3	3.1	16.94	3.0	16.39	2.0	10.93	5.2	28.42	4.5	24.59	0.5	2.73
1972	14.25	3.0	15.58	3.6	18.7	--	--	6.6	34.29	5.4	28.05	0.65	3.38
1973	18.7	3.75	20.05	3.3	17.64	--	--	6.5	34.76	4.5	24.06	0.65	3.48
1974	29.42	4.75	16.15	3.6	12.24	--	--	10.72	36.44	7.7	26.17	2.65	9.01
1975	27.0	1.5	5.56	4.8	17.78	--	--	8.2	30.37	10.5	38.89	2.0	7.41
1976	32.17	2.5	7.77	4.8	14.9	--	--	8.86	27.54	14.86	46.19	1.15	3.57
1977	42.18	5.0	11.85	4.8	11.38	5.0	11.85	11.03	26.15	14.35	34.02	2.0	4.75
1978	43.5	6.0	13.79	5.4	12.41	5.0	11.49	9.0	20.69	15.4	35.40	3.0	6.90
1979	47.45	7.5	15.81	5.4	11.38	7.5	15.81	8.8	18.55	15.0	31.61	3.25	6.85

Table 2-52

Relative Importance of Inputs for Wheat Per Feddan in Dakahlia Governorate

Years	Value of T. inputs	Animal		Seeds		Manure		Chemical Fertilizer		Mechanical Power		Others	
		Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
1965	17.3	7.55	52.80	2.5	17.48	--	--	3.75	26.22	--	--	0.5	3.50
1966	17.8	8.5	47.75	3.0	16.85	--	--	5.8	32.58	--	--	0.5	2.81
1967	17.8	8.5	47.75	3.0	16.85	--	--	5.8	32.58	--	--	0.5	2.81
1968	17.8	8.5	47.75	3.0	16.85	--	--	5.8	32.58	--	--	0.5	2.81
1969	16.96	2.45	14.45	3.0	17.69	--	--	5.8	34.20	5.21	30.72	0.5	2.95
1970	17.91	1.9	10.61	3.0	16.75	--	--	5.8	31.27	6.91	38.58	0.5	2.79
1971	17.91	3.7	20.67	3.0	16.76	--	--	5.8	32.40	4.9	27.37	0.5	2.79
1972	17.5	4.4	25.14	3.0	17.14	1.5	8.57	5.7	32.57	3.4	19.43	0.5	2.85
1973	18.8	3.7	18.62	3.0	15.96	1.5	7.98	6.7	35.64	3.6	19.15	0.5	2.66
1974	21.94	3.7	16.86	3.0	13.67	--	--	9.69	44.17	5.05	23.02	0.5	2.28
1975	33.92	1.75	5.16	4.2	12.38	5.25	15.48	9.69	28.57	12.03	35.47	1.0	2.95
1976	36.2	1.75	4.83	4.2	11.6	5.0	13.81	9.69	26.77	14.56	40.22	1.0	2.76
1977	40.27	1.5	3.72	4.2	10.43	5.0	12.42	11.03	27.39	17.54	43.56	1.0	2.48
1978	44.87	2.5	5.57	4.5	10.03	5.0	11.14	11.03	24.58	18.84	41.99	3.0	6.69
1979	45.99	3.0	6.52	4.5	9.78	5.0	10.87	10.8	23.48	18.74	40.18	3.95	8.59

Table 2-53

Relative Importance of Inputs for Wheat Per Feddan in Domiatte Governorate

Years	Value of T. inputs	Animal		Seeds		Manure		Chemical Fertilizer		Mechanical Power		Others	
		Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
1965	14.6	6.6	45.21	2.5	17.12	2.5	14.12	2.5	17.12	—	—	0.5	3.42
1966	16.55	6.2	37.46	3.0	18.13	2.5	15.11	4.35	26.28	—	—	0.5	3.02
1967	15.5	6.2	40.00	3.0	19.35	—	—	5.8	37.42	—	—	0.5	3.25
1968	16.25	6.95	42.77	3.0	18.46	—	—	5.8	35.69	—	—	0.5	3.08
1969	16.75	7.35	43.88	3.0	17.91	3.0	17.91	2.9	17.31	—	—	0.5	3.0
1970	16.25	7.35	45.23	3.0	18.46	3.0	18.46	3.35	20.62	—	—	0.5	3.08
1971	17.25	5.6	32.46	3.0	17.39	2.5	14.49	3.35	19.42	2.3	13.33	0.5	2.9
1972	18.64	5.25	28.23	3.0	16.13	3.0	16.13	3.35	18.01	3.5	18.82	0.5	2.69
1973	18.44	1.2	6.51	3.0	16.27	3.0	16.27	3.24	17.57	7.5	40.67	0.5	2.71
1974	21.32	1.2	5.63	3.6	16.89	—	—	7.37	34.57	8.65	40.57	0.5	2.35
1975	25.77	1.5	5.82	3.6	13.97	—	—	7.37	28.60	12.3	47.73	1.0	3.88
1976	29.92	1.45	4.85	3.6	12.03	4.5	15.04	7.37	24.63	12.0	40.11	1.0	3.34
1977	36.27	2.5	6.9	4.2	11.59	6.0	16.56	8.04	22.19	14.5	40.01	1.0	2.76
1978	36.84	3.5	9.5	4.8	13.03	6.0	16.29	8.04	21.84	11.5	31.22	3.0	8.14
1979	45.6	2.0	4.39	4.8	10.53	10.0	21.93	6.0	13.16	19.0	41.67	3.8	8.33

Table 2-54

Cultivated Area, Yield, Total Production for Summer Maize in Egypt

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	930,689	12.27	11,419,554
1966	10,532,237	12.32	1,297,850
1967	1,095,198	11.44	12,530,388
1968	1,168,896	11.51	13,455,764
1969	1,143,468	12.35	14,126,541
1970	1,152,855	12.33	14,211,212
1971	1,170,496	12.07	14,132,025
1972	1,210,224	12.33	14,923,727
1973	1,303,079	11.75	15,313,587
1974	1,386,602	11.4	15,806,856
1975	1,425,753	11.56	16,884,650
1976	1,490,313	12.24	18,246,768
1977	1,322,703	11.85	15,678,227
1978	1,404,551	12.75	17,905,871
1979	1,412,999	12	16,962,409
1980	1,432,727	13.17	18,864,614

Source: Ministry of Agriculture, Agricultural Research Center, Agricultural Economics Research Institute.

Table 2-55

Cultivated Area, Yield, Total Production for Summer Maize in Dakahlia

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	36,236	11.74	425,411
1966	54,987	11.15	613,099
1967	57,871	11.42	660,978
1968	69,082	11.31	781,407
1969	55,706	12.2	679,781
1970	57,182	13.16	752,716
1971	55,465	12.6	698,877
1972	58,125	13.3	772,940
1973	70,260	11.68	820,462
1974	73,394	11.64	854,219
1975	76,217	13	991,004
1976	71,338	13.2	941,994
1977	47,896	12.57	602,053
1978	52,367	16.38	857,628
1979	57,495	12.77	734,424

Table 2-56

Cultivated Area, Yield, Total Production for Summer Maize in Domiatte

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	5,187	7.57	39,266
1966	7,527	7.8	58,747
1967	6,406	7.6	48,713
1968	10,335	8.34	86,202
1969	7,657	8.87	67,891
1970	6,620	9.68	64,102
1971	5,476	8.33	45,595
1972	5,668	8.33	47,221
1973	6,555	7.87	51,576
1974	7,534	9.14	62,843
1975	6,953	7.62	53,003
1976	6,936	7.42	51,493
1977	4,540	8.26	37,512
1978	6,568	9.76	64,129
1979	5,625	9.38	52,268

Table 2-57

Cultivated Area, Yield, Total Production
for Summer Maize in Sharkia

Years	Area (feddan)	Yield (Ardab)	Production (Ardab)
1965	151,397	12.14	1,837,960
1966	154,864	12.23	1,893,745
1967	164,152	9.96	1,635,720
1968	165,762	10.012	1,678,235
1969	174,393	11.52	2,009,133
1970	175,303	11.88	2,083,307
1971	195,372	11.51	2,248,094
1972	181,436	12.4	2,249,931
1973	194,432	12.07	2,345,876
1974	224,686	11.34	2,555,736
1975	206,658	11.78	2,433,689
1976	204,113	10.84	2,212,239
1977	183,789	10.84	1,993,163
1978	199,247	12.41	2,473,389
1979	205,112	12.58	2,579,411

Table 2-58

Average Costs Per Feddan (Summer, Maize) at the level of Egypt

	Workers		Animals		Seeds		Organic		Chemical		Mechanical		Insecticides		Others		Total	
Year	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
1965	8.1	36.3	4.0	17.9	1.1	4.9	4.4	19.7	3.6	16.2	0.4	1.8	0.3	1.4	0.4	1.8	22.3	
1966	8.9	35.5	4.3	17.1	1.2	4.8	4.3	17.1	4.8	19.1	0.5	2.0	0.4	1.6	0.7	2.8	25.1	
1967	9.3	33.9	4.5	16.4	1.5	5.5	4.7	17.2	6.1	22.2	0.4	1.5	0.2	0.7	0.7	2.6	27.4	
1968	9.8	35.0	4.3	15.4	1.4	5.0	5.0	17.9	6.2	22.0	0.6	2.0	0.1	3.6	0.6	2.1	28.0	
1969	9.5	33.6	4.0	14.0	1.3	4.6	5.1	18.0	6.3	22.3	1.3	4.6	0.1	0.4	0.7	2.5	28.3	
1970	9.6	33.1	4.0	13.8	1.2	4.1	5.0	17.2	6.9	23.8	1.7	5.9	—	—	0.6	2.1	29.0	
1971	9.8	33.6	3.9	13.4	1.3	4.5	4.9	16.8	6.8	23.2	1.7	5.8	—	—	0.8	2.7	29.2	
1972	10.4	32.9	3.9	12.3	1.2	3.8	5.7	18.0	7.3	23.2	2.4	7.6	—	—	0.7	2.2	31.6	
1973	11.4	35.0	3.8	11.7	1.2	3.7	5.8	17.9	7.2	22.2	2.6	8.0	—	—	0.5	1.5	32.5	
1974	13.7	36.3	4.3	11.4	1.6	4.2	6.2	16.5	7.5	19.9	3.5	9.3	—	—	0.9	2.4	37.7	
1975	18.2	40.9	4.5	10.1	1.6	3.6	7.4	16.6	7.6	17.1	4.0	9.0	—	—	1.2	2.7	44.5	
1976	23.0	44.1	5.7	10.9	1.6	3.1	7.9	15.2	7.7	14.8	4.7	9.0	—	—	1.5	2.9	52.1	
1977	26.6	40.7	7.5	11.5	1.9	2.9	9.4	14.4	10.4	15.9	7.7	11.8	—	—	1.9	2.8	65.4	
1978	36.5	44.9	5.4	6.6	2.2	2.8	10.5	12.9	10.5	12.9	13.6	16.7	—	—	2.6	3.2	81.3	
1979																		

Table 2-59

Net Return Per Feddan of Summer Maize in Egypt

Year	Main Product Yield per-F KM	Main Product Farm Price L.E.	Main Product Revenue L.E.	By-Product Yield per-F	By-Product Farm Price L.E.	By-Product Revenue L.E.	Total Revenue	Total Cost Without Rent	Net Return
1970	12.33	4.69	57.83	7.13	0.9	3.57	61.4	41.5	19.86
1971	12.07	4.68	56.49	7.12	0.68	4.84	61.33	41.6	.20
1972	12.33	5.15	63.50	7.20	0.745	5.36	68.86	44.4	25.18
1973	11.75	6.31	74.14	7.18	0.87	6.25	80.39	45.08	35.35
1974	11.4	7.11	81.05	7.08	0.79	5.59	86.64	50.99	35.59
1975	11.56	7.12	82.25	7	0.92	6.44	88.69	59.92	29.12
1976	12.24	7.04	86.17	7	1	7	93.17	71.01	22.21
1977	11.85	10.66	126.32	7.38	1.72	12.92	139.24	75.11	54.24
1978	12.75	10	127.5	7.4	1.91	14.13	141.163	102.93	38.66
1979	12	10.37	124.44	7.4	2.42	17.91	142.35		

Table 3-1

Summary Statistics for East Delta Data: Means and (Standard Deviations)

	Rice	Wheat	Cotton	Maize
Output (kg)	6,110.1 (9,024.9)	2,046.1 (2,822.6)	2,143.8 (3,453.8)	1,815.0 (2,054.0)
Land (feddan)	3.1 (4.8)	1.8 (2.5)	2.6 (3.9)	1.5 (1.8)
Hired Labor (man-days)	102.5 (223.4)	28.9 (89.9)	163.2 (312.7)	28.9 (60.2)
Family Labor (man-days)	42.5 (70.8)	13.3 (13.6)	31.2 (51.1)	21.7 (24.6)
Machine Power (hours)	192.4 (312.3)	57.9 (74.8)	64.8 (91.5)	41.2 (47.0)
Animal Power (hours)	158.1 (263.3)	59.9 (76.1)	107.7 (211.1)	72.9 (71.7)
Manure	252.9 (651.9)	41.4 (92.5)	354.3 (828.4)	308.1 (389.9)
Nitrogen (kg)	98.9 (179.7)	75.0 (121.0)	137.1 (246.3)	71.9 (104.1)
Phosphate (kg)	19.9 (58.2)	10.7 (30.6)	19.4 (47.8)	.42 (2.1)
Crop Price (L.E./kg)	.09 (.008)	.05 (.005)	.23 (.021)	.06 (.005)
Sample Size	154	119	141	97

Table 3-2

Correlation Matrix for Cotton Production Data

	Output	Land	Hired Labor	Family Labor	Machine Power	Animal Power	Manure	Nitrogen	Phosphate
Output	1.00000	0.77156	0.61101	0.19084	0.82467	0.36454	0.62468	0.7181	0.34025
Land		1.00000	0.90695	0.24278	0.79029	0.53083	0.60605	0.85435	0.67387
Hired Labor			1.00000	0.17208	0.71557	0.58924	0.63722	0.80679	0.69203
Family Labor				1.00000	0.16749	0.49545	-.03057	0.35761	.08979
Machine Power					1.00000	0.46449	0.64889	0.722	0.45243
Animal Power						1.00000	0.66805	0.71327	0.39746
Manure							1.00000	0.77785	0.47556
Nitrogen								1.00000	0.50765
Phosphate									1.00000

Table 3-3

Least Squares Estimates of Cobb-Douglas Profit Function for Rice
Input Demand Equation for:

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Constant	5.505 (2.40)	9.531 (3.412)	1.751 (0.712)	31.957 (5.281)	8.032 (2.930)	-14.866 (-3.699)
MP Price	-0.586 (0.749)	-4.021 (-4.223)	1.040 (1.241)	-8.736 (-4.235)	-1.088 (-1.164)	2.908 (2.123)
AP Price	0.900 (1.345)	-3.491 (4.285)	0.813 (1.133)	3.145 (1.782)	-0.701 (-0.871)	1.254 (1.069)
Wage Rate	-0.514 (-.601)	3.459 (3.319)	-1.395 (-1.521)	6.821 (3.022	0.279 (0.273)	-1.507 (-1.006)
M Price	0.536 (1.292)	-1.243 (-2.461)	0.462 (1.039)	-0.798 (-0.729)	-.034 (-.068)	2.837 (3.904)
N Price	0.082 (.124)	-1.884 (-2.322)	1.857 (2.599)	-7.701 (-4.382)	-0.635 (0.797)	3.297 (2.825)
P Price	-0.874 (-2.227)	2.071 (4.334)	-1.814 (-4.311)	2.038 (1.968)	0.240 (0.512)	.022 (.032)
Land	0.636 (8.097)	0.406 (4.245)	0.894 (10.622)	0.438 (2.116)	0.762 (8.128)	0.439 (3.193)
Family Labor	0.146 (2.737)	0.414 (6.371)	-.043 (-.752)	-0.178 (-1.262)	-.002 (-.024)	-0.175 (-1.867)
R^2	0.444	0.379	0.641	0.267	0.438	0.221
Sum	-.456	-4.393	.963	-5.731	-1.939	8.811

Notes: Number of observations = 153

t-statistics in parentheses.

Sum = total of price coefficients.

Table 3-4

Least Squares Estimates of Cobb-Douglas Profit Function for Cotton
Input Demand Equation for:

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Constant	4.730 (2.969)	1.003 (0.427)	1.274 (0.619)	5.625 (1.065)	6.305 (4.519)	-0.468 (-0.144)
MP Price	-1.729 (-1.984)	1.178 (0.917)	-0.357 (-0.316)	-3.319 (-1.148)	-0.787 (-1.031)	-1.471 (-0.827)
AP Price	0.961 (1.783)	-2.441 (-3.073)	-1.094 (-1.570)	2.442 (1.366)	0.729 (1.543)	0.333 (0.303)
Wage Rate	3.123 (3.695)	1.374 (1.103)	0.882 (0.807)	3.189 (1.138)	0.297 (0.401)	1.421 (0.824)
M Price	0.115 (0.529)	1.482 (4.629)	-0.305 (-1.085)	1.533 (2.128)	-0.516 (-2.711)	-0.416 (-0.938)
N Price	-0.768 (-1.091)	2.272 (2.190)	0.616 (0.678)	-1.289 (-0.553)	-1.427 (-2.315)	-1.514 (-1.055)
P Price	0.369 (0.703)	-1.941 (-2.507)	-0.089 (-0.131)	3.043 (1.747)	0.687 (1.492)	2.648 (2.470)
Land	0.708 (10.150)	0.169 (1.649)	1.079 (11.978)	0.372 (1.607)	0.866 (14.171)	0.593 (4.167)
Family Labor	0.002 (1.503)	0.009 (4.551)	-0.001 (-0.520)	-0.004 (-0.982)	0.002 (1.994)	-.0004 (-.015)
R^2	0.515	0.457	0.609	0.208	0.693	0.176

Notes: Number of observations = 140.

t-statistics in parentheses.

Table 3-5

Least Squares Estimates of Cobb-Douglas Profit Function for Maize
Input Demand Equation for:

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Constant	5.238 (0.931)	4.497 (0.545)	-22.379 (-2.711)	45.916 (2.237)	1.121 (0.139)	20.747 (5.215)
MP Price	-1.489) (-2.232)	-0.556 (-0.568)	2.187 (2.233)	-5.865 (-2.408)	-1.561 (-1.632)	1.411 (2.99)
AP Price	-1.893 (-1.981)	-1.236 (-0.881)	-1.693 (-1.207)	3.334 (0.956)	-1.601 (-1.169)	3.496 (5.171)
Wage Rate	2.607 (2.927)	1.659 (1.269)	-4.456 (-3.408)	8.792 (2.704)	2.149 (1.684)	-1.459 (-2.317)
M Price	0.882 (2.039)	0.372 (0.586)	-1.981 (-3.119)	3.100 (1.963)	-0.103 (-0.166)	1.587 (5.185)
N Price	-0.871 (-1.053)	0.659 (0.544)	0.474 (0.391)	-2.256 (-0.747)	-1.441 (-1.216)	3.499 (5.983)
P Price	0.858 (1.402)	-0.296 (-0.329)	-0.891 (-0.992)	1.824 (0.816)	2.092 (2.386)	-2.542 (-5.873)
Land	0.676 (8.279)	0.496 (4.135)	1.283 (10.702)	0.668 (2.239)	0.844 (7.209)	-0.036 (-0.627)
Family Labor	0.003 (0.964)	0.010 (2.569)	-0.018 (-4.568)	0.004 (0.406)	-0.005 (-1.350)	-0.003 (-1.487)
R^2	0.627	0.496	0.670	0.196	0.489	0.332

Notes: Number of observations = 97.

t-statistics in parentheses.

Table 3-6

Least Squares Estimates of Cobb-Douglas Profit Function for Wheat
Input Demand Equation for:

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Constant	-2.223 (-1.307)	7.684 (2.389)	2.494 (1.131)	3.064 (0.597)	4.891 (2.058)	-5.858 (-1.885)
MP Price	2.484 (3.291)	-0.773 (-0.541)	0.056 (0.058)	0.196 (0.086)	-1.353 (-1.283)	0.803 (0.582)
AP Price	-1.784 (-3.516)	0.432 (0.450)	-0.162 (-0.246)	-0.349 (-0.228)	0.828 (1.167)	-0.257 (-0.277)
Wage Rate	-1.681 (-1.879)	2.177 (1.287)	-0.171 (-0.148)	-2.132 (-0.789)	1.776 (1.421)	-0.442 (-0.270)
M Price	0.438 (2.123)	0.138 (0.353)	0.156 (0.583)	0.083 (0.133)	-0.339 (-1.174)	0.264 (0.700)
N Price	0.493 (0.991)	-1.551 (-1.648)	0.871 (1.349)	1.885 (1.254)	-1.036 (-1.489)	-0.318 ( )
P Price	0.502 (1.202)	-0.347 (-0.439)	-0.826 (-1.524)	-1.165 (-0.923)	0.466 (0.798)	1.713 (2.244)
Land	0.612 (7.952)	0.017 (0.122)	0.980 (9.823)	-0.063 (-0.269)	0.999 (9.291)	0.413 (2.935)
Family Labor	0.019 (3.518)	0.026 (2.516)	-0.010 (-1.440)	-0.009 (-0.594)	-.0023 (-0.316)	-0.021 (2.102)
R^2	0.586	0.115	0.5322	0.080	0.453	0.317

Notes: Number of observations = 119.

t-statistics in parentheses.

Table 3-7

Parameter Estimates of Translog Cost Function for Rice

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
Constant	-.020579	.51369	.042407	.22201	.24642
MP Price	.2519 (.0635)	-.1026 (.0403)	-.0151 (.0511)	-.0363 (.0160)	-.0989 (.0463)
AP Price	-.1026 (.0403)	-.0391 (.0497)	-.0049 (.0401)	.0608 (.0162)	.0769 (.0369)
Wage Rate	-.0151 (.0511)	.0049 (.0401)	-.0346 (.0647)	.0293 (.0169)	-.0875 (.0437)
M Price	-.0363 (.0160)	.0608 (.0162)	-.0293 (.0169)	.0355 (.0091)	-.0150 (.0143)
N Price	-.0989 (.0463)	.0769 (.0369)	.0875 (.0437)	-.0149 (.0143)	-.0578 (.0486)
P Price	-.1109 (.0654)	.1298 (.0364)	-.0478 (.0351)	-.0057 (.0152)	.0253 (.0535)
Land	-.0364 (.0119)	-.0245 (.0067)	.0258 (.0062)	.0008 (.0028)	.0317 (.0102)
Family Labor	.0218 (.0080)	.0115 (.0045)	-.0125 (.0039)	-.0066 (.0019)	-.0121 (.0068)
R^2	.2490	.2356	.3485	.3369	.0922

Notes: Number of observations = 153.

Standard errors in parentheses.

Estimation Method: Iterated SUR.

Test for symmetry $F_{10,864} = 5.5$.

Table 3-8

Parameter Estimates of Translog Cost Function for Cotton

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
Constant	.64021	-.28005	-.31349	.26315	.59708
MP Price	-.0551 (.0978)	.1480 (.0595)	.07691 (.0977)	.0258 (.0180)	-.1798 (.0550)
AP Price	.1480 (.0595)	-.2174 (.0537)	-.1547 (.0570)	.0490 (.0112)	.1549 (.0355)
Wage Rate	.0769 (.0977)	-.1547 (.0570)	.1324 (.1222)	-.0819 (.0200)	.0365 (.0640)
M Price	.0258 (.0179)	.0490 (.0112)	-.0819 (.0199)	.0443 (.0063)	-.0336 (.0122)
N Price	-.1798 (.0549)	.1549 (.0355)	.0365 (.0640)	-.0336 (.0122)	.0460 (.0448)
P Price	.0827 (.0769)	-.1612 (.0452)	-.1328 (.0786)	.0386 (.0191)	.1185 (.0493)
Land	-.0412 (.0119)	-.0232 (.0052)	-.0478 (.0133)	-.0049 (.0036)	-.0213 (.0085)
Family Labor	.0107 (.0087)	.0134 (.0038)	-.0111 (.0094)	-.0004 (.0026)	-.0108 (.0061)
R^2	.2024	.3117	.2361	.5208	.1783

Notes: Number of observations = 140.

Standard errors in parentheses.

Estimation Method: Iterated SUR.

Test for symmetry $F_{10,660} = 13.0$.

Table 3-9

Parameter Estimates of Translog Cost Function for Maize

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
Constant	.218709	.07928	-.10271	.29283	.49815
MP Price	.1335 (.0643)	-.0940 (.0391)	.0577 (.0533)	.0583 (.0258)	-.1631 (.0412)
AP Price	-.0940 (.0391)	.0928 (.0447)	.0538 (.0373)	-.0505 (.0189)	.0139 (.0303)
Wage Rate	.0577 (.0533)	.0538 (.0373)	-.1284 (.0780)	-.0621 (.0193)	.1171 (.0411)
M Price	.0583 (.0258)	-.0505 (.0189)	-.0621 (.0193)	.1012 (.0184)	-.0453 (.0194)
N Price	-.1631 (.0412)	.0139 (.0303)	.1171 (.0411)	-.0453 (.0194)	-.0610 (.0408)
P Price	.0404 (.0571)	-.0292 (.0334)	-.1899 (.0382)	.0214 (.0325)	.1752 (.0491)
Land	-.0108 (.0151)	-.0217 (.0089)	.0433 (.0080)	-.0148 (.0089)	.0053 (.0135)
Family Labor	.0286 (.0098)	.0265 (.0056)	-.0432 (.0052)	.0020 (.0058)	-.0141 (.0087)
R^2	.2960	.4733	.6273	.3791	.2190

Notes: Number of observations = 97.

Standard errors in parentheses.

Estimation Method: Iterated SUR.

Test for symmetry $F_{10,440} = 7.3$.

Table 3-10

Parameter Estimates of Translog Cost Function for Wheat

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
Constant	.010665	.20807	.19973	.0959	.4694
MP Price	.4702 (.0715)	-1.344 (.0399)	-.1657 (.0678)	-.0317 (.0185)	-.1571 (.0494)
AP Price	-.1344 (.0399)	.1162 (.0362)	.0715 (.0402)	-.0318 (.0137)	-.0314 (.0291)
Wage Rate	-.1657 (.0678)	.0715 (.0402)	.1499 (.0842)	-.0100 (.0183)	-.0245 (.0486)
M Price	-.0317 (.0185)	-.0138 (.0137)	-.0100 (.0183)	.0301 (.0099)	.0246 (.0141)
N Price	-.1571 (.0494)	-.0314 (.0291)	-.0245 (.0486)	.0246 (.0141)	.1901 (.0479)
P Price	.1469. (.0618)	-.0466 (.0312)	-.1059 (.0392)	-.0198 (.0177)	-.0015 (.0591)
Land	-.0186 (.0145)	-.0315 (.0073)	.0268 (.0081)	-.0080 (.0042)	.0261 (.1443)
Family Labor	.0183 (.0111)	.0125 (.0057)	-.0269 (.0062)	.0005 (.0033)	.0077 (.0111)
R^2	.5004	.2521	.3787	.1585	.2198

Notes: Number of observations = 119.

Standard errors in parentheses.

Estimation Method: Iterated SUR.

Test for symmetry $F_{10,545} = 19.6$.

Table 3-11

Input Demand Elasticities for Rice Derived From Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
MP Price	.0214 (.1049)	-.2544 (.3380)	.4719 (.4508)	-.7094 (.5813)	-.2122 (.3827)
AP Price	-.0502 (.0666)	-1.2000 (.4166)	.0765 (.3536)	2.3231 (.5885)	.7557 (.3054)
Wage Rate	.0884 (.0845)	.0727 (.3361)	-1.1914 (.5706)	-.9481 (.6139)	.8368 (.3609)
M Price	-.0323 (.0265)	.5372 (.1361)	-.2307 (.1494)	.3140 (.3300)	-.0962 (.1182)
N Price	-.0424 (.0765)	.7661 (.3096)	.8926 (.3850)	-.4215 (.5181)	-1.3368 (.4022)
P Price	-.1698 (.1080)	1.1013 (.3053)	-.4078 (.3093)	-.1929 (.5520)	.2229 (.4423)

Notes: Standard errors in parentheses.

Table 3-12

Input Demand Elasticities for Cotton Derived From Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
MP Price	-.8077 (.2796)	1.9165 (.6299)	.6172 (.3398)	.7653 (.2892)	-.6232 (.2973)
AP Price	.5178 (.1702)	-3.2067 (.5679)	-.4434 (.1983)	.8819 (.1802)	.9329 (.1920)
Wage Rate	.5075 (.2794)	-1.3494 (.6107)	-.2519 (.4250)	-1.0294 (.3195)	.4853 (.3461)
M Price	.1361 (.0514)	.5805 (.1186)	-.2227 (.0691)	-.2249 (.1019)	-.1197 (.0660)
N Price	-.3293 (.1571)	1.8243 (.3755)	.3118 (.2224)	-.3556 (.1960)	-.5663 (.2427)
P Price	.2576 (.2202)	-1.6834 (.4781)	-.4405 (.2732)	.6423 (.3072)	.6624 (.2666)

Notes: Standard errors in parentheses.

Table 3-13

Input Demand Elasticities for Maize Derived From Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer
MP Price	-.2551 (.1446)	-.2644 (.2955)	1.0096 (.5209)	.9779 (.2358)	-.3327 (.1964)
AP Price	-.0788 (.0878)	-.1676 (.3369)	.6586 (.3652)	-.3290 (.1726)	.1987 (.1446)
Wage Rate	.2320 (.1197)	.5079 (.2817)	-2.1535 (.7627)	-.4657 (.1764)	.6604 (.1959)
M Price	.2403 (.0579)	-.2713 (.1423)	-.4979 (.1886)	.0349 (.1686)	-.1066 (.0926)
N Price	-.1569 (.0926)	.3144 (.2288)	1.3550 (.4019)	-.2046 (.1776)	-.4996 (.1946)
P Price	.0924 (.1283)	-.2184 (.2516)	-1.8556 (.3737)	.1969 (.2972)	.8366 (.2341)

Notes: Standard errors in parentheses.

Table 3-14

Input Demand Elasticities for Wheat Derived From Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
MP Price	.4121 (.1389)	-.7428 (.3718)	-1.0404 (.6456)	2.2414 (.9936)	-.1943 (.2302)	9.3828 (3.7172)
AP Price	-.1425 (.0943)	.2147 (.3366)	.7884 (.3828)	-.6326 (.7376)	-.0391 (.1356)	-2.6988 (1.8754)
Wage Rate	-.2031 (.1260)	.7859 (.3739)	.5339 (.8018)	-.4346 (.9839)	-.0092 (.2265)	-6.2664 (1.0682)
M Price	-.0403 (.0343)	-.1125 (.1276)	-.0770 (.1742)	.6356 (.5308)	.1332 (.0659)	1.2091 (1.0682)
N Price	-.0775 (.0918)	-.0780 (.2772)	-.0188 (.4629)	1.5375 (.7606)	.1007 (.2237)	.1230 (3.5564)
P Price	.2899 (.1148)	-.4276 (.2899)	-.9919 (.3736)	1.0807 (.9547)	.0095 (.2754)	-59.516 (11.057)

Note: Standard errors in parentheses.

Table 3-15

Elasticities of Substitution* for Rice Production Based on Estimates of the Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Mechanical Power	.0354 (.1734)					
Animal Power	-.4203 (.5584)	-10.0561 (3.4912)			Symmetric	
Hired Labor	.7796 (.7451)	.6411 (2.9638)	-10.5062 (5.0317)			
Manure	-1.1719 (.9603)	19.4709 (4.9316)	-8.3617 (5.4132)	11.3797 (11.9596)		
Nitrogen Fertilizer	-.3505 (.6322)	6.3335 (2.5599)	7.3793 (3.1828)	-3.4846 (4.2836)	-11.2166 (3.3247)	
Phospate Fertilizer	-12.6637 (8.0579)	82.1559 (22.7767)	-30.4204 (23.0718)	-14.3902 (41.1751)	16.6259 (32.9929)	104.3320 (97.1726)

*Note: Standard errors in parentheses.

Table 3-16

Elasticities of Substitution* for Cotton Production Based on Estimates of the Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Mechanical Power	-2.3095 (.7995)					
Animal Power	5.4802 (1.8014)	33.9387 (6.0105)			Symmetric	
Hired Labor	1.7648 (.9716)	-4.6924 (2.1237)	-.8760 (1.4779)			
Manure	2.1881 (.8264)	9.3336 (1.9068)	-3.5804 (1.1109)	-3.6158 (1.6383)		
Nitrogen Fertilizer	-1.7822 (.8500)	9.8734 (2.0322)	1.6875 (1.2037)	-1.9246 (1.0608)	-3.0649 (1.3155)	
Phospate Fertilizer	12.0956 (10.3374)	-79.0440 (22.4492)	-20.6837 (12.8281)	30.1592 (14.4246)	31.1030 (12.5182)	63.5770 (46.955)

*Note: Standard errors in parentheses.

Table 3-17

Elasticities of Substitution* for Maize Production Based on Estimates of the Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Mechanical Power	.5734 (.3250)	Symmetric				
Animal Power	-.5942 (.6625)	-1.2642 (2.5413)				
Hired Labor	2.2689 (1.1707)	4.9672 (2.7550)	-21.0611 (7.4592)			
Manure	2.1981 (.5299)	-2.4817 (1.3017)	-4.5545 (1.7254)	.3192 (1.5423)		
Nitrogen Fertilizer	-.7479 (.4415)	1.4986 (1.0907)	6.4588 (1.9159)	-.9753 (.8468)	-2.3813 (.9275)	
Phospate Fertilizer	58.1132 (80.6920)	-137.34 (158.2883)	-1166.8972 (235.0270)	123.8209 (186.9182)	526.1433 (147.2542)	

*Note: Standard errors in parentheses.

Table 3-18

Elasticities of Substitution* for Wheat Production Based on Estimates of the Translog Cost Function

	Machine Power	Animal Power	Hired Labor	Manure	Nitrogen Fertilizer	Phosphate Fertilizer
Mechanical Power	.7762 (.2583)					
Animal Power	-1.3811 (.6913)	1.9981 (3.1324)			Symmetric	
Hired Labor	-10.9258 (1.2004)	7.4869 (3.5623)	5.0862 (7.6384)			
Manure	-2.1679 (1.8474)	-6.0520 (6.8637)	-4.1422 (9.3733)	34.1923 (28.5545)		
Nitrogen Fertilizer	-.3613 (.4280)	-.3635 (1.2922)	.0877 (2.1575)	7.1668 (3.5452)	.4694 (1.0429)	
Phospate Fertilizer	17.4458 (6.9114)	-25.7358 (17.4506)	-59.6991 (22.4857)	65.0436 (47.4604)	.5734 (16.5778)	-3582.0644 (664.8811)

*Note: Standard errors in parentheses.

Table 3-19

Area and Yield Trends for Major Crops and Vegetables in Egypt, 1965-1979

Crop	Average Rate of Change in: Area Percent	Yield Percent
Summer Rice	0.7	6.7
Nile Rice	-2.1	16.3
Cotton	-21.1	11.0
Maize	2.5	0.8
Wheat	4.4	14.2
Potatoes	58.5	-0.2
Tomatoes	27.3	4.6
Melons	-11.6	-11.2
Watermelons	18.6	-2.1
Fresh Peas	16.1	5.1
Eggplant	23.8	-4.1
Marrow	19.6	3.8
Cabbage	23.4	-0.7
Green Pepper	27.6	1.0

Table 3-20

Average Numbers of Research Publications Per Year by the Institute of Agricultural Research

Field of Research	1958-1960	1961-1965	1966-1970	1971-1975	1976-1977
Soil and Water	15	20	40	30	26
Cotton and Field Crops	32	28	43	46	54
Horticulture	12	16	27	45	25
Pesticides and Plant Disease	22	33	69	64	45
Livestock	7	11	25	33	33
Animal Health	34	44	46	52	22

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