PN-ACA-096 Econ 27
93107

APCP

Agricultural Production and Credit Project

مشـــروع الانتـــاج الزراعـــى والائتمـــان

AGRONOMIC AND ECONOMIC FACTORS EFFECTING COTTON PRODUCTION IN EGYPT

A Report of the Cotton Supply Response Team

Team Members:

Dr. Gerald T. O'Mara, Team Leader, Chemonics, APCP,
Dr. Ibrahim Soliman, Zagazig University,
Dr. Emad El Hawary, University of Cairo,
Dr. Samir Mostapha, Cotton Research Institute, and
Dr. Abdel Sattar Ahmed Shneshin,
Agriculture Economic Research Institute.

Report prepared by

Dr. Ronald D. Krenz

USAID PROJECT NUMBER: 263-0202
CONTRACT NUMBER: HCC-262-0202-02

Prepared for :

The Principal Bank for Development and Agricultural Credit
Cairo, Egypt

Prepared by :
Chemonics International Consulting Division

APCP Deliverable: WP-VII/7.3.A

DECEMBER, 1994

CHEMONICS
12 Midan El Sheikh Youssef — Garden City — Cairo — Tel : 354-8334 — Fax (20/2) 354-8757
١٢ ميدان الشيخ يوسف ــ جاردن سيتى ــ القاهرة ــ كيمونكس ــ تليفون : ٣٥٤٨٣٣٤ ــ فاكسيميلى : ٣٥٤٨٧٥٧ (٢٠/٢)

A

AGRONOMIC AND ECONOMIC FACTORS EFFECTING COTTON PRODUCTION IN EGYPT

A Report of the Cotton Supply Response Team

Team Members:

Dr. Gerald T. O'Mara, Team Leader, Chemonics, APCP,
Dr. Ibrahim Soliman, Zagazig University,
Dr. Emad El Hawary, University of Cairo,
Dr. Samir Mostapha, Cotton Research Institute, and
Dr. Abdel Sattar Ahmed Shneshin,
Agriculture Economic Research Institute.

Report prepared by

Dr. Ronald D. Krenz

USAID PROJECT NUMBER: 263-0202
CONTRACT NUMBER: HCC-262-0202-02

Prepared for :

The Principal Bank for Development and Agricultural Credit
Cairo, Egypt

Prepared by :
Chemonics International Consulting Division

APCP Deliverable: WP-VII/7.3.A

DECEMBER, 1994

B

TABLE OF CONTENTS

	Page
FOREWORD	i
ACRONYMS	iii
LIST OF TABLES	iv
EXECUTIVE SUMMARY	vii
CHAPTER I. COTTON PRODUCTION PRACTICES	1
Characteristics of cotton production	1
Egyptian Cotton Quality	7
History of cotton varieties in Egypt	8
History of cotton yields in Egypt	9
Cotton Pest Control in Egypt	13
Fertilization of cotton	16
Rental Value of Cotton Land	18
CHAPTER II. RECENT TRENDS IN COTTON PRODUCTION, PRICES, EXPORTS AND IMPORTS	19
Cotton production	19
Farmgate Procurement Prices	20
Export Prices	21
Border Prices	22
Export Taxes	23
Competitive world prices	24
Cotton Exports	25
Deliveries to Domestic Cotton Mills	30
Cotton Imports	31
CHAPTER III. THE USE OF LABOR IN COTTON PRODUCTION	32
Characteristics of the Agricultural Labor Force	32
Current Situation of Agricultural Labor	32
Supply of Agricultural Labor	32
Demand for Agricultural Labor	33
Wages in The Agricultural Sector	37
Labor demand versus supply in the agricultural sector	38
CHAPTER IV. COST OF PRODUCTION SURVEYS	40
Sampling	40
Questionnaires	41
Enumeration	41
Land use on sample farms	41
Livestock on sample farms	44
Labor use on sample farms	47
Yields versus harvest labor requirements	50
Size of operation versus harvest labor requirements	54
Cautions	56
Fertilizer Costs	56
Miscellaneous costs	57

CHAPTER V. COST BUDGETS 58
Cotton 58
Maize..... 61
Wheat..... 64
Fava Beans..... 67
Berseem..... 69
Rice..... 74

CHAPTER VI. COMPARATIVE RETURNS TO CROPPING ROTATIONS..... 79
INPUT SUBSIDIES..... 80
Seeds..... 80
Pesticides..... 82
Interest on crop production loans..... 83
Fertilizer..... 84
Irrigation cost subsidies..... 85
YIELD TRENDS..... 86
HARVEST LABOR..... 88
PRODUCT PRICES..... 88
EMODEL..... 89
EMODEL RESULTS..... 95
Effects of input prices..... 95
Effects of product prices..... 96
Impact on incomes..... 99
Short Season Cotton.....100

ANNEX I. MALR SYSTEM FOR MAINTAINING YIELDS IN EGYPTIAN COTTON VARIETIES.....102

ANNEX II. COTTON SURVEY QUESTIONNAIRE.....105

ANNEX III. SCOPE OF WORK OF ORIGINAL STUDY TEAM.....109

FOREWORD

The original study team was organized during the summer of 1992 and given the responsibility to conduct a study of cotton supply response (See Annex III for the Scope of Work). This study team chose the methodology of multi-market modeling because this methodology provides a framework for appraising the effects of policy changes on resource allocation and assessing who gains and who loses.

The use of a mathematical model to study economic policy is, in a sense, a social and economic experiment. The policy maker cannot try out an economic policy in one village or province to see what happens. That would take to long and may be very disruptive. Several years may pass before a real, but even small, local economy would adjust to some price changes. Policy decisions cannot wait for such types of experiments. Thus, experiments must be simulated mathematically. Assumptions must be made and models must be built which portray human decision making and response to economic variables.

The intentions of the team were to use the GAMS algorithm and the EASM-89 data model. They intended to add livestock enterprises to the model, augment the model with expansion to include all cotton varieties, and perhaps also expand the model from a static model into a multi-period dynamic model. Emphasis was to be on estimation of the area planted to cotton by Egyptian farmers as a response to various policy variables.

Due to circumstances beyond the control of the original study team the full intentions of the team could not be completed. This report presents background information on cotton production practices, GOE policies related to cotton production, trends in past production and trade, labor aspects of cotton production and cost of production estimates for cotton and competing crops. This information was primarily intended to serve as input into the multi-market study but hopefully will be useful in any study of Egyptian cotton production.

Dr. Gerald T. O'Mara, Chemonics, was the leader of the Cotton Supply Response Study Team

Dr. Ibrahim Soliman, Zagazig University, prepared the modeling of livestock for the model modifications.

Dr. Samir Mostapha, of the Cotton Research Institute contributed Chapter I. Cotton Production Practices.

Dr. Emad El Hawary, University of Cairo, contributed Chapter II. Recent Trends in Cotton Prices, Exports and Imports.

Dr. Abdel Sattar Ahmed Shneshin, AERI, MALR, contributed Chapter III. The Use of Labor in Cotton Production.

Dr. Ronald D. Krenz, Chemonics, APCP, contributed to the design and conduct of the cost of production surveys made by MALR, analyzed and summarized the cost data presented in this report, developed the EMODEL, and prepared the final draft of this report.

ACRONYMS

ARC	Agricultural Research Center
APCP	Agricultural Production and Credit Project(USAID)
CAPMAS	Central Agency for Public Mobilization and Statistics
CAS	Central Administration of Seeds
CPI	Consumer price index
EASM-89	Egyptian Agricultural Sector Model as of March, 1989
ELS	Extra long staple cotton
FAO	Food and Agriculture Organization, United Nations
GAMS	General Algebraic Modeling System
GOE	Government of Egypt
LE	Egyptian Pound (Monetary unit)
LS	Long staple cotton
MALR	Ministry of Agriculture and Land Reclamation
MSIT	Ministry of Supply and Internal Trade
PBDAC	Principal Bank for Development and Agricultural Credit
U/AES	Undersecretariat for Agricultural Economics and Statistics, MALR
USAID	U.S. Agency for International Development

LIST OF TABLES

1.1. Net revenue of the major cropping rotations, 1986-1992.
1.2. Summary of cotton planting and harvest dates.
1.3. Cotton yields before and after MALR measures to improve the Egyptian cotton varieties in 1958/59 season.
1.4. Use of pheromones by the MALR in treatment of pink boll worms.
2.1. Cotton area, yield and production, Egypt, 1961-94.
2.2. Administered farmgate cotton procurement prices by variety, 1986-1993, Grade Good + 1/4.
2.3. Export selling prices for cotton lint by variety, major export varieties, 1986/87-1993/94.
2.4. Computed border prices, 1986-1991.
2.5. Export tax on cotton varieties, 1986-1991:
2.6. Farm procurement prices as a percent of border prices, 1986-1991.
2.7. Ratios of export prices to several competing types of cotton during 1986/87-1991/92.
2.8. Computation of export tax based on estimated world market value, 1986-1991.
2.9. Exports of ELS Egyptian cotton by variety(1980/81 - 1993/94).
2.10. Exports of LS Egyptian cotton by variety,(1980/81 - 1993/94).
2.11. Exports of Egyptian ELS cottons, by countries of destination, 1986/87 - 1993/94.
2.12. Exports of Egyptian LS cottons by countries of destination, 1986/87 - 1993/94.
2.13. Cotton mill deliveries by variety, 1985/86 - 1992/93.
2.14. Egyptian cotton imports by country of origin, (1974/75 - 1991/92).

3.1. Labor force in agricultural and non-agricultural sectors, (1986-91).
3.2. Total demand for agricultural labor during 1991.
3.3. Requirements of crops for labor of men, 1990.
3.4. Requirements of crops for labor of women, 1990.
3.5. Requirements of crops for labor of children, 1990.
3.6. Total wages In Egypt,(1981-1991),(Millions of workers and Million LE).
3.7. Supply and demand of agricultural labor force, 1991.

4.1. Land use on sample farms in governorates producing ELS cotton varieties.
4.2. Land use on sample farms in governorates producing cotton variety Giza 75.
4.3. Land use on sample farms in governorates producing other LS cotton varieties (excluding Giza 75).
4.4. Livestock on farms producing ELS varieties of cotton.

4.5. Livestock on farms producing Giza 75 cotton.
4.6. Livestock on farms producing other LS cotton varieties.
4.7. Livestock on all sample farms.
4.8. Labor use by operation, cotton, Gharbiya.
4.9. Results from regression analysis of relationships between harvest labor and yield, four crops.
4.10. Results from regression analyses of relationships between area of crop and harvest labor requirement, five crops.

5.1. Seed, manure, fertilizer and pesticide costs, all varieties of cotton, 1991.
5.2. Machinery and animal costs, all varieties of cotton, 1991.
5.3. Labor costs, all varieties of cotton, 1991.
5.4. Summary of costs and receipts, all varieties of cotton, 1991.
5.5. Seed, manure, fertilizer and pesticide costs, maize, all governorates, 1991.
5.6. Machinery and animal costs, maize, all governorates, 1991.
5.7. Labor costs, maize, all governorates, 1991.
5.8. Summary of costs and receipts, maize, all governorates, 1991.
5.9. Seed, manure, fertilizer and pesticide costs, wheat, all governorates, 1991-92.
5.10. Machinery and animal costs, wheat, all governorates, 1991-92.
5.11. Labor costs, wheat, all governorates, 1991-92.
5.12. Summary of costs and receipts, wheat, all governorates, 1991-92.
5.13. Seed, manure, fertilizer and pesticide costs, fava beans, all governorates, 1991-92.
5.14. Machinery and animal costs, fava beans, all governorates, 1991-92.
5.15. Labor costs, fava beans, all governorates, 1991-92.
5.16. Summary of costs and receipts, fava beans, all governorates, 1991-92.
5.17. Seed, manure, and fertilizer costs, long berseem, all governorates, 1991-92.
5.18. Machinery and animal costs, long berseem, all governorates, 1991-92.
5.19. Labor costs, long berseem, all governorates, 1991-92.
5.20. Summary of costs and receipts, long berseem, all governorates, 1991-92.
5.21. Summary of costs and receipts, short berseem, all governorates, 1991-92.
5.22. Sample of rice producers, 1991.
5.23. Input costs, rice, all governorates, 1991.
5.24. Harvest costs for rice with and without combines, 1991.
5.25. Labor costs, rice, all governorates, 1991.
5.26. Summary of costs and receipts, rice, all governorates, 1991.

6.1. Sources of seeds, 1992-93 crop season.
6.2. Cotton pest control subsidies.
6.3. Prices paid for fertilizer by farmers purchased from private sector merchants, 1992-93 cropping season.
6.4. Cost of fertilizer by crop and study area, (1992-93 free market prices).
6.5. Average yields of major crops in Egypt, (1979-1992).
6.6. Comparisons of returns to crop rotations under various input price scenarios.
6.7. Comparisons of returns to crop rotations under various price scenarios for ELS cotton.
6.8. Comparisons of returns from ELS cotton versus rice under various price scenarios.
6.9. Comparisons of returns to crop rotations under various price scenarios for Giza 75 variety, LS cotton.
6.10. Comparisons of returns to crop rotations under various price scenarios for other LS cotton varieties.
6.11. Break-even prices of cotton with other rotations with various number of cuttings of berseem.

EXECUTIVE SUMMARY

Cotton is a very important crop in Egypt, both to the economy and to the average farmer. Cotton is also a major crop in the Agricultural Policy Reform Program. Cotton production has been tightly controlled by the GOE for several decades through area controls, controls on quantities of inputs, and most importantly by requiring farmers to market their seed cotton to the government at prices below world market levels. These policies led to gradual reduction in cotton output from an average output of 10,400,000 kentars in 1969-72 to 5,965,000 kentars in 1988-91.

A major policy question at present in regard to cotton is "What will happen to cotton production and income to cotton producers under conditions of free input and product markets?". The GOE may be reluctant to completely liberalize the cotton markets with out any knowledge of the possible outcomes for this very important crop.

The Cotton Supply Response Study was designed to shed light on this matter. The study team chose to approach the problem with the use of an analytical general equilibrium programming (GAMS) model. As the Egyptian economy moves toward liberalization a market equilibrium model becomes very appropriate for policy experimentation. Movement towards liberalization does not eliminate the need for policy experimentation but only changes the type of policies that will be considered. The GOE will no doubt continue to see a need to examine the impacts on the cotton subsector of economic policies. Perhaps not of farm procurement price policies but perhaps of new land development or tenure policies, or new international trade policies. Thus, the pursuit of the development of a general equilibrium model would serve as a very useful policy analysis model and should be continued.

This report is intended to provide background information and data needed for the multi-market model or other quantitative models. Compilation and analysis of the cost of production survey data provided estimation of individual crop budgets.

Adjustment of the basic crop budgets to free market input prices was performed with a computerized spread-sheet model. This model, called the "EMODEL" provides a simple method to deal with a multitude of variables and allows comparisons of returns between rotations to allow simple analyses of cotton or other commodities. The spread-sheet model does not provide the analytical capability of a multi-market model since it does not include any capability to deal with the demand side of the market equation, it deals only with production alternatives, but it can be useful to the policy analyst. We recommend continuing efforts to develop an appropriate mathematical model to improve the policy analysis capabilities of Egyptian agriculture.

CHAPTER I. COTTON PRODUCTION PRACTICES

Characteristics of cotton production

Cotton is one of the most important agricultural crops in Egypt. As an export crop, it is vital to Egypt's national economy. It also provides raw material for the country's first industry, namely spinning and textile production. In addition, it provides edible oil and raw materials for feed production. Other industries, such as ginning and oil extraction, are based on cotton production. Similarly, other economic activities, such as land and sea transportation are affected by cotton production.

Cotton production requires an intensive amount of human labor. The total labor requirement for production of the 1990 cotton crop, (almost one million feddans) has been estimated at 7 percent of the available agricultural adult male work days, 16 percent of annual women work days and 21 percent of the children work days.(See Chapter 3, page 32).

During the 1980s cotton producers exhibited little interest in growing cotton. In 1991 the area planted to cotton declined to less than one million feddans compares with almost two million feddans in the 1950s and 1960s (see Table 2.1). In 1992, the area further declined to about 850,000 feddans, thus providing glaring evidence of a lack of interest in cotton. This decline occurred despite some governmental threats to penalize producers who did not produce their cotton quotas. This lack of interest in cotton production is possibly due to the lack of profit incentives and the competition of other more lucrative crops.

Despite increases in cotton's administered prices, net revenues per feddan of cotton were still far below those of other alternative crops until 1991. This is true because of the large increases in cotton production costs vis-a-vis the increase in its administered price and in those of the other more lucrative alternative crops. The major cotton rotation, (short-season berseem/cotton) was the least profitable when compared with the other alternative crops during the period of 1986-1990. The net revenues were, in some alternative rotations, double those of the cotton rotation. Examples of these are the berseem/rice rotation in 1986 and the berseem/maize rotation in 1988 (Table 1.1).

However, the difference between the cotton based and alternative rotations narrowed in 1990, although the short-season berseem/cotton rotation remained the least profitable.

Table 1.1. Net revenue of the major cropping rotations, 1986-1992.

Crop	Gross Revenue	Cost	Net Revenue	Index
1 9 8 6				
Cotton	676.32	540.88	135.44	
Short Berseem + Cotton	944.72	634.23	310.49	100.00
Wheat + Rice	1267.38	708.67	558.71	179.94
Wheat + Maize	1128.89	676.23	452.66	145.79
Long Berseem + Maize	1040.87	506.50	534.37	172.10
Long Berseem + Rice	1179.36	538.94	640.42	206.26
Bean + Maize	1063.45	621.24	442.21	142.42
1 9 8 7				
Cotton	743.36	595.29	148.07	
Short Berseem + Cotton	1165.56	739.97	425.59	100.00
Wheat + Rice	1231.15	777.36	453.79	106.63
Wheat + Maize	1286.13	709.35	576.78	135.52
Long Berseem + Maize	1449.83	616.50	833.33	195.80
Long Berseem + Rice	1394.85	684.51	710.34	166.91
Bean + Maize	1313.19	654.65	658.54	154.74
1 9 8 8				
Cotton	818.20	612.71	205.49	
Short Berseem + Cotton	1198.20	722.50	475.70	100.00
Wheat + Rice	1407.85	826.52	581.33	122.20
Wheat + Maize	1516.61	781.00	735.61	154.64
Long Berseem + Maize	1564.98	593.80	971.18	204.16
Long Berseem + Rice	1456.22	639.32	816.90	171.72
Bean + Maize	1443.06	725.20	717.86	150.91
1 9 8 9				
Cotton	1065.15	652.04	413.11	
Short Berseem + Cotton	1453.95	771.25	682.70	100.00
Wheat + Rice	2195.72	882.30	1313.42	192.39
Wheat + Maize	2221.52	878.32	1343.20	196.75
Long Berseem + Maize	1830.54	690.12	1140.42	167.04
Long Berseem + Rice	1804.74	694.10	1110.64	162.68
Bean + Maize	1874.11	843.55	1003.56	147.00
1 9 9 0				
Cotton	1424.50	783.90	645.60	
Short Berseem + Cotton	1908.50	926.81	986.69	100.00
Wheat + Rice	2514.94	1004.61	1510.33	153.07
Wheat + Maize	2539.06	1016.61	1522.45	154.30
Long Berseem + Maize	2094.09	760.26	1333.83	135.18
Long Berseem + Rice	2069.97	748.26	1321.71	133.95
Bean + Maize	2128.29	1022.32	1105.97	112.09

Table 1.1 cont.

Crop	Gross Revenue	Cost	Net Revenue	Index
1 9 9 1				
Cotton	1924.83	879.00	1045.83	
Short Berseem + Cotton	2488.83	1048.00	1440.83	100.00
Wheat + Rice	2758.10	1256.80	1501.30	104.20
Wheat + Maize	2575.80	1190.80	1385.00	96.12
Long Berseem + Maize	2359.20	900.60	1458.60	101.23
Long Berseem + Rice	2541.50	966.60	1574.90	109.31
Bean + Maize	2172.50	1209.30	963.20	66.85
1 9 9 2				
Cotton	2759.30	991.20	1768.10	
Short Berseem + Cotton	3439.30	1168.00	2271.30	100.00
Wheat + Rice	2940.80	1502.80	1438.00	63.31
Wheat + Maize	2677.60	1376.80	1300.80	57.27
Long Berseem + Maize	2603.10	1033.60	1569.50	69.10
Long Berseem + Rice	2877.30	1159.60	1706.70	75.14
Bean + Maize	1921.90	1360.40	561.50	24.72

Source: U/AES, MALR.

The GOE increased the cotton farmgate prices throughout the period from 1987 through 1992 (See Table 2.2), however, the gap in returns between the berseem/cotton rotation versus other rotations was not really reduced until 1990 and was not closed until 1991. By 1992 the berseem/cotton rotation gave returns that were far better than all other major field crop rotations. Thus, we can expect farmers to respond with increased area plantings in the future and better yields (See Chapter II).

The improvement of the cotton crop depends, in the first place, on the time of planting and the proper field management starting from seed-bed preparation to picking and delivery. The lack of such optimal management has led to negative effects that can be briefly enumerated as followed:

1. A decline in the area planted to cotton as a result of the lack of profit incentives.

2. Late planting: MALR recommends the month of March as an optimal time for planting cotton. For Upper Egypt, the first two weeks of March is the optimal period for planting while the last two weeks of the month is optimal for planting in lower Egypt. The majority of cotton producers delay planting in order to grow a winter crop prior to cotton.

Experiments have proven that planting after the optimal period leads to a gradual decline in cotton yield per feddan and in lint qualities, in addition to greater infestation of late season

bollworms. In a study on a new variety, Giza-83, recommended for southern Upper Egypt, it was proven that early planting led to a significant increase in yield. The highest seed cotton yield was achieved from planting in mid-March. Research results recorded a decrease in yield by 23.9 percent, 41.3 percent and 50.5 percent for planting on mid-April, May 1st and mid-May respectively.

It can be concluded that delays in planting after the end of March lead to significantly lower cotton yields. The decrease reaches about 30 percent for planting in mid-April, 45 percent for planting on May 1st and 50 percent for planting in mid-May.

As part of a study of short season cotton conducted in 1994,[1] data were gathered on actual average planting dates for all major Egyptian field crops. The results for cotton planting and harvesting are presented in Table 1.2.

Table 1.2. Summary of cotton planting and harvest dates.

Crop and Governorates:	Length of growing season (days)	Average date of: Planting	Harvest
Assuit	197	Mar. 19	Sept 24
Sohag	178	Mar. 26	Sept 21
Minya	181	Mar. 25	Sept 23
Fayoum	189	Mar. 11	Sept 17
Beni Suef	196	Mar. 25	Oct. 8
AVE. UPPER EGYPT	188	Mar. 21	Sept 26
Behira	197	Mar. 27	Oct. 11
Daqahliya	193	Mar. 24	Oct. 4
Damietta	193	Mar. 18	Sept 27
Gharbiya	200	Mar. 23	Oct. 9
Kafr El Sheikh	186	Mar. 30	Oct. 2
Menifiya	202	Mar. 19	Oct. 7
Qalubiya	190	Mar. 18	Sept 24
Sharqiya	201	Mar. 25	Oct. 12
AVE. LOWER EGYPT	196	Mar. 24	Oct. 6
OVERALL AVERAGE	192	Mar. 23	Oct. 2

3. Loss in cotton production: This problem has not received due attention and has not been seriously studied. As a result of these declines in cotton production the domestic and export market requirements were not fulfilled. This situation is further aggravated by the difficulties in importing foreign cottons in view of the sharp precautions imposed by the agricultural quarantine and the technical difficulties in using

---

1. See footnote No. 13, Chapter VI of this report.

the imported cotton at a larger scale through out the country; thus restricting the cotton mills capacities to use imported cottons.

Loss, quantitative or qualitative, may be the ultimate result of the following factors:-

3.1 Low yield per feddan as a result of late planting, improper performance of the agronomic practices, neglecting the second picking due to the high cost of picking as compared to the value of the second picking cotton.

3.2 Ginning of seed cotton by illegal gins for upholstery uses as a result of the high value of cotton in that use as compared to prices paid for compulsory delivery. The amount of seed cotton illegally sold and processed outside the government channels is estimated at 100 thousand kentars. This phenomenon is disappearing as a result of increase in the procurement prices during the last two years (1991-92).

3.3 Low grades: The deterioration of cotton grades constitutes a loss in the crop's economic value, reducing direct returns. The average grade of cotton has seriously deteriorated with the initiation of the present marketing system.

The government has set a scale of premiums to improve cotton grade. However, these grade premiums were not an accurate reflection of market value differentials and thus failed to encourage producers to improve cotton grades. Grade deterioration may be attributed to the following reasons:

3.3.1. High cost of labor which discourages producers from doing a second picking.

3.3.2. Negligence of removing trash content to improve grade due to the high cost of the practice, thus leading to heterogeneous seed cotton inside the same sack.

3.3.3. Exposure of seed cotton to hazardous storing conditions inside the gins due to the lack of covered storing areas, or the high cost of storage if storehouses were, at all, available at cotton gins.

3.4 Imperfect Sacks: During the process of classing or arbitration, cotton sacks are exposed to several perforations which develop into larger holes. Other holes appear with the use of hooks during the process of weighing. An amount of seed cotton is lost because of dropping out either on the way to gins or on the ground of store areas at the gins.

3.5 Imperfect Packaging: Loose bales, resulting from imperfect binding, and negligence of covering the consignment of cotton lint with canvas during transportation expose lint to contamination, impurities and loss of considerable quantities.

3.6 Inadequate Storing Conditions: Due to the flow of seed cotton into the gins over a short span of time, lack of sufficient storage space and insufficient work force at the gins, a quantitative and qualitative loss is incurred during storage.

3.7 Probable Fire: At the gins or pressing units or during transportation, fires may occasionally take place as result of inadequate storing conditions and consequently lead to a considerable loss in tradeable lint quantities.

3.8 Un-economic Use of High Quality Lint: The National Spinning Mills use high quality cotton to produce low quality yarn. This constitutes an economic loss, for such yarn can be produced from very low grades. The spinning mills are exerting an utmost effort to spin at higher counts (more than 50 counts). But there is still much to do in order to fully utilize the superb spinning qualities of the Egyptian cotton.

In view of these factors contributing to the quantitative and/or qualitative damage of lint, the total loss is estimated not less than 5 percent of the annual crop, e.g. 296,000 kentars out of the 5.9 million kentars of 1990, 210,000 ardeb of cotton seeds that may produce 3,300 tons of cotton seed oil and about 22,000 tons of cotton seed meal in addition to 4,000 kentars of upholstery cotton.

Egyptian Cotton Quality:

Egyptian cotton is the leader of the world's long staple cottons. It possesses well known qualities that make it superior to almost all other cottons in the world. It is particularly distinguished by higher fiber strength, fiber maturity and lower waste. Cotton which possesses a high percentage of mature fibers leads to a decrease in the costs of production and produce more attractive fabrics. The uniformity of properties from one lot to another and from one season to the next makes Egyptian cotton suitable for the production of materials where satisfactory quality is essential.

Technically speaking, there are two outstanding features of Egyptian cotton that readily draw the attention of the keen spinners. The first is the close association between the different properties of the fiber such as staple length, fineness, and hair strength, so that a longer variety is generally finer and stronger and the balance is very remarkable.

The second feature is the time honored system of grading in Egyptian cotton which creates a scale of different classes within a single variety generally differing in yarn and hair properties.

The "International Cotton Advisory Committee" (ICAC) has attempted to estimate and report the production of world cotton by staple length categories since 1960's. The categories used are:

o	Short	(under 13/16 inch)
o	Medium	(13/16 to 1 inch)
o	Medium-long	(1 1/32 to 1 3/32 inch)
o	Long	(1 1/8 to 1 5/16 inch)
o	Extra-long	(1 3/8 inch and longer)

The estimates of cotton production by staple length have had limited value. Many countries use different definitions of staple length categories. For example, some countries combine the short and medium categories and report only cotton of 1" or less. Other countries lump together all cotton with staple lengths 1 1/32" to 1 1/4" making it impossible to differentiate between the medium long and long categories or between the long and extra long staple (ELS) categories. A related problem is that classing practices differ from one country to another, so that two cottons each said to have a given staple length, can actually have significantly different spinning characteristics.

Perhaps the strongest reason why estimates of cotton production by staple length have had little practical meaning is that cotton is not bought and sold by staple length alone. While staple length is one of the criteria used to describe types of cotton, other criteria like color, trash contents, strength, fineness, and preparation are also important. Consequently, two types of cotton of equal staple length can have markedly different economic values.

Cottons within a given type are presumably close substitutes for each other as raw material for the textile industry. The region of origin and grade are the most convenient labels used to identify a particular type of cotton, and it makes the most sense to use this information in trying to classify cottons according to their types. The categories of cotton by type are:

1. Waste/Padding
2. Coarse Count (yarn counts 1's through 19's)
3. Medium Count (yarn counts 20's through 30's)
4. High A (yarn counts 31's through 40's)
5. Fine count (yarn counts 41's through 50's
6. Extra-Fine Count (yarn counts 51's and higher)*

History of cotton varieties in Egypt:

In the 1950/51 season, the area of ELS varieties (over 1 3/8") covered 38 percent of the total cotton area in Egypt, and was composed mainly of the Karnak variety, but with an appreciable acreage of original Menoufi. The only long staple variety in the 1 1/4" - 1 3/8" category was Giza 30 which formed about 19 percent of the total area. The area of the 1 1/8 - 1 1/4" staple category still consisted of Ashmouni with about 43 percent of the cotton area, somewhat less than half of the total.

Ten years later the ELS category occupied 52 percent for the total area, 22 percent for the over 1 1/4" category and 26 percent for the over 1/8" category. By the 1960/61 season Karnak and Giza 30 had passed their heydays, and their areas fell to 17 and 7 percent of the total cotton area respectively, and original Menoufi disappeared to be replaced by Improved Menoufi. Four new varieties appeared on the list, i.e. Giza 45 in the ELS category and Giza 47, Dandera, and 'Bahtim 185' in the long staple category of over 1 1/4"

In the 1970's the area of the ELS category amounted to 44 percent of the total area, followed by the area of the over 1 1/4" staple category (29 percent) and the over 1 1/8" staple category 27 percent in the third place. Between 1960/61 and 1970/71, the area of Giza 45 had increased to 7 percent of the total area. Besides Giza 45 the ELS group has become mainly composed of improved Menoufi, and Giza 68. In the over 1 1/4" staple group, Giza 30 was replaced by Giza 47 which in turn was replaced by the higher yielding varieties Giza 67 and Giza 69, Giza 66 and Ashmouni shared the over 1 1/8" staple group.

By the 1980/81 season the fiber length composition of the Egyptian cotton crop had changed. Varieties over 1 1/8" were displaced by long staple varieties over 1 1/4". Area of ELS varieties accounted for 44 percent of the 1970/71 crop, but fell to 30 percent in 1980/81 season. Varieties over 1 1/8" declined from 27 percent in 1970/71 to only about 6 percent in 1980/81. The area of long staple varieties over 1 1/4" increased in the same period from 29 percent in 1970/71 to 64 percent in 1980/81.

In the category of ELS cottons, Giza 45 remains the distinguished superfine cotton of the world. Giza 70 "Isis", which was introduced in the 1970/71 season, proved to be substantially higher in quality and yield over Giza 68 and Improved Menoufi. Giza 70 area quickly rose to dominance and caused the disappearance of Improved Menoufi followed by Giza 68. Two new varieties in this ELS category are Giza 77 and Giza 76.

Regarding the over 1 1/4" category, Giza 75 was developed which exceeds its parents, Giza 67 and Giza 69, in yield and yarn strength. Among the over 1 1/8" category, Ashmouni variety, the

oldest cotton variety, was withdrawn from cultivation in 1978/79 season after a span life of 117 years followed by Giza 72 in 1979/80. Giza 66 remained in cultivation for another season and the 1980/81 witnessed the last crop of long staple category of over 1 1/8" in Egypt.

By the 1990/91 season there were nine Egyptian cotton varieties, four of them, (Giza 45,67,70 and 77) were of the ELS category. The other five varieties were of the long staple category (over 1 1/4"), i.e. Giza 75, Giza 81, Giza 80, Dandera and the new promising variety for Upper Egypt Giza 83. In the 1990/91 season the ELS category occupied about 25.5 percent of the cotton area. The long staple variety Giza 75 occupied 49.6 percent of all the cotton area in the 1990/91 season.

In 1990-91 a new long staple variety, Giza 83, was introduced for Upper Egypt. In 1991-92 Giza 84 was introduced which is of the ELS category for Lower Egypt and Giza 85, an LS variety, was introduced for Middle and Lower Egypt. These three new varieties all have the characteristic of having a shorter growing season, about 10 days shorter than the other varieties now in use.

History of cotton yields in Egypt:

During the period from 1950/1951 to 1992/93 the cotton area ranged from more than 1.9 million feddans in six seasons, i.e. 1950, 51, 52, 58 and 1965 seasons, to less than 1.0 million feddans in six seasons, i.e. 1983, '84, '87, '90, '91 and '92. (See Table 2.1). Total cotton production varied during this period from more than 10 million kentars of lint in eight seasons (1960,'64, '65, '69, '70, '71, '72 and 1980 season) to only 5.8 - 5.9 million kentars in the 1989/90, 1990/91 and 1991/92 seasons. With respect to the yield per feddans it varied from 3.38 kentar per feddan (k/fd) in 1961, 3.96 k/fd in 1951/52 and 3.99 k/fd in 1955/56 season to more than eight kentars in seven successive seasons from 1979/80 season to 1985/86 season and in 1992.

Since 1950, however, it was felt that average yield per feddan for Egyptian cotton was declining, and the three leading commercial varieties during that time: Karnak, Giza 30 and Ashmouni started to show serious signs of deterioration. To remedy the situation, the Ministry of Agriculture and Land Reclamation (MALR) investigated the shortcomings of the existing cotton production systems, and took several technical, control and regulatory measures to improve the Egyptian cotton varieties, in both yield and quality.

The MALR considered the fact that cotton varieties, if grown in mixed variety areas, are liable to show signs of deterioration more readily than varieties produced in one-variety areas.

Starting with the 1958/59 season, varieties were allocated to areas best suited for their growth, with respect to yield and quality.

Thus, the one-variety-area system was established. The one-variety-per-gin system was also introduced in 1958/59. Instead of ginning more than one variety of cotton, as was commonly practiced, each gin is permitted to handle only the one cotton variety assigned to it.

Realizing the role of high quality seed in maintaining and promoting the quality of the crop, a new system has been devised for annual releases of pure seed. (See Annex 1). In the meantime the MALR expanded the area of propagation fields for registered and certified seed. In the 1964/65 season, the certified seed available for distribution was enough to cover for the first time the entire cotton acreage. Since then, all of the cotton area in Egypt is planted annually with certified seed produced from fresh crops of registered seed released from foundation seed originally grown on the Ministry's seed farm.

To protect its worldwide reputation, Egyptian cotton is kept under strict government control and supervision at all stages from planting to export. Such control is based not only on legislative measures but also on the provision of advisory services.

Legislation covers the various stages of cotton production including the allocation of area under the crop, seed production and distribution , ginning and pressing. Advisory services are made available to the cotton growers to enable them to adopt improved methods for cultivation and protection of the crop.

These measures to improve the cotton crop resulted in a continual rise in yields (Table 1.3). The yield per feddan rose from 4.37 kentars in the 1955 - 57 period to 5.44 kentars in 1958 - 60 period, and to 4.78 kentars in 1961 - 63 period in spite of the great damage of cotton crop in 1961/62 season as a result of severe attack from leaf worms.

These measures were based on results obtained by several investigators on the causes of varietal deterioration. Moore (1941) observed that stocks from 'run-down' or 'run-out' varieties appeared to be mixed with those of other varieties. He measured the influence of any internal genetic change upon fiber length in mass self and open pollinated progenies of Mexican strains of American upland cotton. He noted no change in the combined fiber length of in its variability after one, two, or three years of either mass self or open-pollinating. His results and observations made of 'run-out' varieties indicated that

registered varieties or varieties eligible for registration do not 'run-out' as measured by length of fiber where contamination of seed is avoided.

Table 1.3. Cotton yields before and after MALR measures to improve the Egyptian cotton varieties in 1958/59 season.

Period / Season	Average Lint Yield (k/f)
Before:	
1940 - 42	5.41
1943 - 45	5.15
1946 - 48	5.32
1949 - 51	4.40
1952 - 54	4.98
1955 - 57	4.37
After:	
1958 - 60	5.44
1961 - 63	4.78*
1964 - 66	5.54
1967 - 69	6.00
1970 - 72	6.52
1973 - 75	5.96
1976 - 78	6.44
1979 - 81	8.33
1982 - 84	8.26
1985 - 87	7.62
1988 - 90	5.94
1991	6.84
1992	8.51
1993	7.78

* The 1961/62 cotton crop was badly damaged by a severe attack of leaf worms, and the yield per feddan was only 3.38 k/fd.

O'Kelly (1942) tested five standards varieties to determine what changes occur . He found that the proportion of bare seed increased as the variety was reproduced year after year. A decrease in lint percent was observed as reproduction progressed, but changes in seed cotton yields and staple length were too small and variable to be properly evaluated. The results he obtained supported the belief that the chief cause of cotton varietal deterioration resulted from the mixing of varieties whether in field, places of storage, or at gins.

Moore and Dick (1950) studied the deterioration in quality of successive generations of two varieties of upland cotton. They found that even with very careful growing, handling and ginning, the spinning quality decreased.

Simpson and Duncan (1953) suggested that if rapid deterioration in a well-bred variety of cotton occurred, it is due, most probably, to faults in production and processing methods.

Later, Lewis (1970) in discussing the causes of varietal deterioration quoted Kadam's opinion. Lewis cited important causes for genetic changes, i.e. mechanical mixtures, natural crosses, mutations, gin frequency changes caused by random genetic drift and natural selection, gene frequency changes caused by selection pressure exerted by the breeder, and loss of heterozygosity.

To determine the amount and nature of deterioration of the pure nuclei in Egyptian cotton varieties after handling by the farmers, Mostafa (1976) compared the seed in general planting (farmers seed) with the corresponding pure nuclei. The main cotton variety for upper Egypt during the period from 1962 till 1981 "Giza 66" was used in this study. The only nuclei of "Giza 66" in general planting in the two seasons, 1973 and 1974, were Giza 66/66, 66/67, 66/68, 66/69 and Giza 66/70. The farmers seed of these nuclei had been compared with the corresponding pure nuclei to test what changes might have occurred in these nuclei after their release to farmers. The results obtained from this study indicated that:

1. Farmers seed did not differ significantly from corresponding nuclei and latest nuclei '70' with respect to seed cotton yield, seed index, boll weight, fiber length, and fiber fineness.

2. Lint yield of the oldest strain Giza 66/66 decreased about 27 percent less than the corresponding nuclei, and about 22 percent less than the latest nucleus '70'. The decrease was only 1 percent for Giza 66/70 than '70 Nucleus'.

3. The oldest strain Giza 66/66 decreased by 15 percent in lint percent than the corresponding nucleus and by 12 percent than the latest nucleus '70'. The decrease was only 1 percent for Giza 66/70.

4. In lint index the decrease was about 21 percent for Giza 66/66 than the corresponding nucleus and about 18 percent more than '70 Nucleus'. Giza 66/70 did not differ from '70 Nucleus'.

5. Lint yield started to deteriorate after the second year of general planting. Both lint percent and lint index deteriorated badly in the fifth year of propagation.

6. Yarn strength of Giza 66/66 decreased with about 16 percent than the corresponding nucleus, and with about 17 percent more than the 70 nucleus'. The difference was only 5 percent for Giza 66/70.

7. Difference in yarn strength exceed the + 5 percent permissible range after two years only of general planting. The results indicated clearly that Egyptian cotton varieties went out of cultivation rather because they mixed and deteriorated than because they were valueless in their pure state.

Cotton Pest Control in Egypt:

Most cotton in Egypt is planted in March and April and requires a growth period of about 7 months (See Table 1.2). Insect pests play an important role in cotton production in Egypt as in other cotton producing countries. Although the control of cotton pests is almost entirely dependent upon chemical pesticides, other measures of control are practiced.

Major Cotton Insect Pests:

Early season pests:

1. Mole cricket, Gryllotalpa gryllotalpa var. cophta DeHaan (Orthoptera, Gryllotalpidae).
2. African mole cricket, Gryllotalpa africana Pal. (Orthoptera, Gryllotalpidae).
3. Cotton thrips, Thrips tabaci Lind. (Thysanoptera, Thripidae).
4. Cotton aphids, Aphid gossypii Glover (Homoptera, Aphididae).
5. Greasy cutworm, Agrotis ipsilon Hufn (Lepidoptera, Noctuidae).
6. Red common mite, Tetranychus telarius (Acarina, Tetranychidae).

Mid Season Pests:

1. Egyptian cotton leafworm, Spodoptera littoralis Boisd, (Lepidoptera, Noctuidae).
2. Lesser cotton leafworm, Spodoptera exiqua Hubn, (Lepidoptera, Noctulidae).

Late Season Pests:

1. Pink bollworm, Pectinophora gossypiella Saund, (Lepidoptera, Gelechidae).
2. Spiny bollworm, Earias insulana Boisd, (Lepidoptera, Noctuidae).
3. Red common mite and the green common mite.

The cotton leafworm, S. littoralis, and the pink bollworm, P. gossypiella, are the two main cotton insects in Egypt. The cotton leafworm is extremely polyphagous having, beside cotton, a very wide host range of field and truck crops. The pink bollworm has a direct impact on the cotton yield, and about 84 percent of the insecticides used for cotton pest control are directed against pink bollworms.

Some other pests occasionally show up, such as the American bollworm, Heliothis armigera Boddie, the white fly, Bemisia tabaci Gen., and the green bug, Nezara viridula L. in few restricted areas.

Assessing Insect Activity:

1. Soil sampling is carried out in berseem fields at the beginning of March to the end of June to assess the abundance of cotton leafworm immature stages (larvae and pupae) for the purpose of predicting the size of the first generation of the pest in cotton fields. However, in most cases, no sound relationship is found between the figures obtained from berseem fields and the size of infestation on cotton.

2. Light and pheromone traps are used to determine the size of populations of the cotton leafworm and bollworm and their fluctuations during the season.

3. Hand picking of egg masses of cotton leafworm shows the size of each generation in different cotton growing areas.

4. Weekly examination of green bolls to estimate pink bollworm infestation in cotton fields. If the level of infestation reaches 10 percent, cotton fields should be sprayed immediately.

5. The economic injury level for the American bollworm, Heliothis armigera, is determined at 20 young larvae per 100 cotton plants.

Determining When to Spray:

1. The cotton thrips: Spraying of cotton with insecticides to control cotton thrips is very common. However, an economic threshold level for chemical control of this pest has been determined as 8-12 individuals per plant, depending on plant age.

2. Hand-picking egg masses of the cotton leafworm is done with reasonable efficiency during June and early July, covering the first generation of the insect on cotton. Should the egg masses hatch, chemical treatment should be applied immediately in order to kill the still young larvae since the advanced grown larvae are more resistant to most available insecticides.
3. Starting the beginning of July, at one week intervals, groups of technicians examine samples of green bolls for bollworm infestation in the samples reaches 10 percent in an area, spraying starts.

Selection of Pesticides:

All chemical insecticides undergo thorough scientific screening, testing and evaluation in more than 10 experiment stations belonging to the MALR. Each insecticide is tested for three successive seasons. Its effect on the target insect, the natural enemies, the cotton plant itself, its hazards to man and animals and its impact in polluting the environment are all taken into consideration when testing new insecticide. The results obtained annually are used by the MALR committee in recommendations of the chemicals to be applied in the following season.

Costs and subsidization of main Insecticides

The GOE has for many years conducted a program of pest control for cotton which was completely operated by the MALR, including much heavier subsidization than for any other crops. In earlier years this program included control of early season pests but in later years concerned itself primarily with the late season pests, such as the pink boll worm. The program included both the hand removal of worm eggs and the chemical program.

The application of insecticides to control cotton pests cost about L.E. 154.6/FD in the 1990/1991 season. However, the government subsidized this amount and the farmer paid only L.E. 20 per feddan. Substantial subsidization of pest control costs on cotton continued through the 1993 crop year but MALR announcements in early 1994 indicated that producers would bear all pest control costs in 1994.[2]
Actually, in 1991 the GOE began shifting some of the pest control task to the cotton producer. In 1991 the cost of some pest control practices managed by the government were paid by the farmer and some farmers conducted their own control program. in 1991, 47 percent of the producers of ELS varieties and 17 percent of the producers of LS varieties performed some chemical pest control activities on their own, in addition to the MALR programs. In 1992 these same percentages were 53 percent and 31 percent. In 1993, overall, 31 percent of the cotton producers conducted their own pest control program.

Also in 1991 farmers were given options to conduct some programs on their own or pay the government for these services. This shifting of both the costs and the responsibility for pest

---

2. Detailed information on GOE costs of the cotton pest control program, and farmers pest contol programs, can be found in Chapter 5 of the Tranche IV, V, and VI reports to the Agricultural Policy Reform Project, USAID/Cairo. Also see table 6.2 of this report.

control was continued in 1992 and 1993 so that subsidies are being reduced and the producer is gradually taking over the management of the program.[3]

Use of Pheromones

The 1993 MALR cotton pest control program differed significantly from that of previous years in that in 1993 it included a major expansion in the use of pheromones to control pink bollworms. The MALR treated 101,452 feddans of cotton planted in 1993 with pheromones primarily in Upper and Middle Egypt (Table 1.4). However, a survey conducted by the Economic Affairs Sector of MALR indicated that chemical pesticides were also used on pink boll worms on all except 33,000 feddans. This indicates that pheromones were used as the major control method on these 33,000 feddans but were supplemented with traditional chemical pesticides. Use of pheromones were further expanded in 1994.

Fertilization of cotton:

Under intensive cultivation, the Egyptian croplands generally need to be enriched with macro-nutrient elements, namely nitrogen, phosphorus and potassium, which are essential for plant growth and fruiting. Cotton usually responds well to these three major elements.

MALR has made the following recommendations on fertilization for the 1992 cotton plantings:

There should be a balance among the three major nutrients so as to avoid the effect of an increased ratio of nitrogenous fertilizers on vigorous vegetative growth at the expense of flowering and boll formation.

Nitrogenous Fertilizers:

Nitrogenous fertilizers should be applied at an average rate of 62 Kg. N./Fd., in two equal applications, one immediately after thinning and the other before the second irrigation. The application of nitrogenous fertilizers should be completed before flowering.

In case of late plantation and/or adding manure during seedbed preparation at a rate of $20m^3$/FD, the rate of nitrogen per feddan should be reduced by 10-15 Kg. If cotton is grown after vegetable crops, intensively fertilized with nitrogen or manure, the same ratio is to be reduced, provided that the application is undertaken before the third irrigation.

---

3. See Chapters 1 and 5 of the Tranche VI report for the APCP Policy Reform Program, USAID-Cairo.

Table 1.4. Area of cotton treated with pheromones by the MALR in treatment of pink bollworms.

Governorate	1991	1992	1993
		(Feddans treated)	
Alexandria	---	---	2611
Behira	1000	---	---
Kafr el Sheikh	---	1000	4000
Daqahliya	2500	3010	4977
Sharquia	---	---	5950
Lower Egypt	3500	4010	17538
Beni Suef	---	4000	15914
Fayoum	---	766	10000
Minya	3000	16090	20000
Middle Egypt	3000	20856	45914
Assuit	2000	14035	16000
Sohag	---	9510	22000
Upper Egypt	2000	23545	38000
Total	8500	48411	101452

Phosphorous Fertilizers:

Phosphorous fertilizers should be applied at an average rate of 22.5 Kg. P_2O_5/FD before ridging. In case of late planting, phosphorus is applied before the first irrigation particularly in the bottom of ridges. It is also recommended that nitrogenous and phosphorous fertilizers not be mixed but applied separately on both sides of plant hills. However, ammonium sulfate may exceptionally be mixed with phosphorous fertilizers before the application.

Potassium Fertilizers:

Potassium should be added at the rate of 2.4 Kg. of K per feddan in case of its proven deficiency. The application is made after thinning and on both sides of plant hills. The potassium fertilizer (potassium oxide) is added separately except in case of mixture with single superphosphates.

Cost of Fertilization:

In 1990, the total subsidy on fertilizer was estimated at LE 59,407,000 on a total cotton area of 993,047 feddans. The cost was estimated at about LE 60/FD which constitutes about 30 percent of fertilizers and pesticides subsidies for that year.

After phasing out subsidies, cotton producers shall pay the market price of fertilizers. Though this rationalize the use of fertilizers, it will eventually increase production costs by an amount equivalent to the subsidy incurred by the government.

In view of the foregoing, it appears that fertilizer subsidies increased from LE 25 million in 1981/82 to about LE 59 millions in 1990/91, i.e. from about LE 20.8 per feddan in 1981 to about L.E. 60 in 1990/91. Similarly, pest control subsidy increased from LE 72.6 per feddan to about LE 117 over the same period.

Estimates of costs of production of cotton and major alternative crops without subsidies are presented in Chapter VI.

Rental Value of Cotton Land:

Since the issuance of the Agrarian Reform Act in 1952, the rental value per feddan was estimated at seven times of land tax. Recently, Act 96 of 1992 was issued, whereby the rental value shall be raised to 22 times of land tax starting from the crop year 1992/93. This means that the rental value increased from about LE 154/FD to about LE 484/FD or an increase of LE 330. This amount is yet another component in production costs. Starting from the 1993 season, the cost of cotton production per feddan shall rise by the same amount of increase in the agricultural land rental and the values of subsidy to fertilizers, provided that subsidies on pest control on cotton currently borne by the government shall continue to exist.

CHAPTER II. RECENT TRENDS IN COTTON PRODUCTION, PRICES, EXPORTS AND IMPORTS

This chapter reviews recent trends in cotton production, procurement prices, export prices, exports, imports and deliveries to the mills. Also, calculations are made of the farmers share of the export price.

Government intervention in agriculture and especially for cotton has been prominent for decades in Egypt. At the same time, cotton yields have deteriorated and the area planted has declined which resulted in a decrease in domestic cotton production. This can largely be attributed to inappropriate policies.

Cotton production:

Table 2.1 summarizes data on area, yield, and total production of cotton in Egypt from 1961 to 1993. During the decade of the 1960's the cotton area varied from about 1.5 to 2.0 million feddans with an average of 1.7 million and with yields averaging 5.5 metric kentar. No discernible trends in area or yields were noted.

During the decade of the 1970s the area planted to cotton gradually declined. During the first three years of the decade the average area was 1,560,000 feddans compared to 1,210.000 feddans during the last three years. On the other hand, national average cotton yields generally increased during this decade. Yields for the 1970s were about 1.2 metric kentar greater than during the 1960's and were on an upward trend at the end of the decade.

During the 1980s this upward trend in yields came to a stop and reversed itself with yields gradually returning to about 6 kentar /feddan by the end of the decade. The area planted to cotton continued its downward trend resulting in a major reduction in total production. By the end of the decade, total annual production was only about 2/3rds of what it was at the start of the decade.

The decade of the 1990s started from a very low level of total annual production. The initial years of the 1990s indicate the possibility of a reversal in this downward trend in production.

Table 2.1. Cotton area, yield and production, Egypt, 1961-94.

Year *	Area	Yield	Total Production
	(000) Feddan	M.Kentar	(000) Metric Kentar
Average 1961-70	1,701	5.45	9,275
1971	1,525	6.68	10,194
1972	1,552	6.62	10,271
1973	1,600	6.12	9,790
1974	1,453	6.07	8,812
1975	1,346	5.68	7,642
1976	1,248	6.35	7,925
1977	1,423	5.60	7,974
1978	1,189	7.38	8,767
1979	1,196	8.09	9,672
1980	1,245	8.50	10,574
Average 1971-80	1,378	6.65	9,162
1981	1,178	8.40	9,985
1982	1,066	8.64	9,208
1983	998	8.02	8,004
1984	984	8.12	7,984
1985	1,081	8.05	8,706
1986	1,055	7.64	8,055
1987	980	7.17	7,021
1988	1,014	6.13	6,211
1989	1,006	5.73	5,766
1990	993	5.96	5,919
Average 1981-90	1,035	7.39	7,686
1991	851	6.84	5,826
1992	840	8.51	7,147
1993	884	7.78	6,878
1994	866**		

Source: Egyptian Cotton Gazette, July 1993.
* Year planted. ** Preliminary.

Farmgate Procurement Prices:

The decline in cotton area and production prompted economic reform of the cotton program in 1986. In order to induce farmers to plant more acreage of cotton, the procurement prices, which were set by the administration, were increased during the period 1986-93 (Table 2.2). The prices of the ELS varieties (Giza 45, 76, 70, and 77) were increased relatively more than the prices of the LE varieties (Giza 75, 80, 81, and Dandera). Substantial price increases were given during 1989, 1990, 1991 and 1992. The impacts on net income and returns from cotton versus other crops were demonstrated in Table 1.1.

Table 2.2. Administered farmgate cotton procurement prices by variety, 1986-1993, Grade Good + 1/4. *

Variety	1986**	1987	1988	1989	1990	1991	1992	1993
				(LE per Seed Kentar)				
Giza 45	126	165	222	300	380	480	563	498
Giza 76	114	118	148	217	267	317	455	390
Giza 70	108	117	147	216	256	306	426	361
Giza 77	103	104	142	203	251	301	388	323
Giza 75	105	100	131	191	237	277	298	281
Giza 81	89	92	129	185	230	270	287	270
Giza 80	93	112	141	197	252	282	291	274
Dandera	91	115	141	197	252	282	291	274

Source:Egyptian Cotton Authority
* Nominal prices, (no adjusted for inflation)
** Year of cotton production.

Export Prices:

The export prices of Egyptian cotton have been administered by the Government of Egypt (GOE) for many years. Export prices for each variety and grade are set each year by a joint decision of representatives of the Ministry of Economy and Foreign Trade, the Cotton Affairs holding Company, and the five nationalized cotton trading companies (Table 2.3). The committee increased the export prices of all varieties each year between 1986/87 and 1989/90 but decreased them each year since then.

Table 2.3. Export selling prices for cotton lint by variety, major export varieties, 1986/87-1993/94.*

Year	G.45	G.76	G.70	G.77	G.75	G.81	Dandera
		(FOB, US cents/lb.)(Grade = good + 1/4)					
1986/87	149	143	139	139	106	106	106
1987/88	200	184	182	178	145	147	143
1988/89	275	254	234	229	174	174	174
1989/90	285	264	244	239	179	179	179
1990/91	285	254	231	226	164	154	138
1991/92	200	162	154	149	114	109	NS
1992/93	195	132	121	115	90	85	NS
1993/94	165	108	101	91	81	78	NS

Source: Egyptian Cotton Gazette, July 1994. NS = No sales.
* Data for 1986/87 applies to the crop produced in 1986 and mainly sold in 1987.

Unfortunately, the GOE past policy has been to set export prices at the opening of each market season and hold to this same set of prices for the entire market season. This policy tends to lead

to less than optimal effects each year, either by depressing sales when prices are set too high or by depressing exchange earnings when prices are set too low.

Border Prices:

Border prices are defined as the domestic farmgate equivalent of the cotton export prices. Border prices are here calculated using export prices as the starting point and by performing the following adjustments or calculations:

a) Convert from US cents/lb to LE/KG,
b) Adjustments for FOB and transportation expenses,
c) Adjustment for ginning expenses,
d) Adjustment for by-product values of seed and scarto,
e) Adjustment for ginning out-turn.

The results (Table 2.4) are prices to the cotton producer per kentar of seed cotton. A border price which is equal to the farm level procurement price implies that the farmer is paid the full export or international market value of the cotton with no return above costs to the marketing or ginning process or to the GOE. Deviations between the farm procurement price and the border price imply excess profits in the marketing chain or, in this case a profit taking or tax by the government. Since prior to 1994 market season all cotton producers were required to sell all of their cotton to the GOE, and the GOE controls all cotton exports, the GOE had monopsony control over purchases of domestic cotton.[1]

Table 2.4. Computed border prices. 1986-1991.

	1986	1987	1988	1989	1990	1991
			(LE/Seed Kentar)			
Giza 45	497.70	681.40	951.10	907.70	987.70	682.25
Giza 76	482.40	713.00	973.30	1013.40	973.20	606.89
Giza 70	522.50	705.60	909.30	1062.00	897.20	552.49
Giza 77	497.50	711.80	928.70	971.30	915.90	587.25
Giza 75	401.70	557.80	688.60	709.80	646.60	434.47

---

1. However, these computed border prices (Table 2.4) do not represent true farm level equivlents of world prices. As explained above, the export prices of Egyptian cotton have been administered prices set by GOE official and not determined by the interaction of market forces. Thus, the computed border prices in Table 2.4 are not true border prices but are the farm level equivalents of the administered export prices. Determination of true border prices would reguire the availability of world price data. Since Egyptian cottons are quite unique, true world market values are not easily estimated.

Export Taxes:

Thus, during this period the GOE was in a position to extract a tax on the cotton producer. Granted however, the GOE did not actually collect this tax on all the cotton it purchased from the producer, only on what it sold on the export market. This tax should be considered as a subsidy or transfer payment to the textile industry on all cotton that was sold to the domestic cotton textile industry.

Table 2.5 shows that the taxes per kentar increased substantially for all varieties in 1987 and 1988. In 1989 the export tax per kentar decreased for all varieties except Giza 76. Export taxes declined substantially in 1990 for Giza 70, 77 and 75 and substantial reductions occurred in 1991 for all varieties since procurement prices were increased substantially and export prices declined.

Comparing border prices with the procurement prices during the period 1986-1991 show that procurement price averaged well below 30 percent of border price during the period 1986-1989 (Table 2.6). Due to substantial increases in procurement prices in 1990 and 1991, and decreased export prices in 1991-92, the percentage paid to the producer increased substantially in 1991.

Part of this tax was a tax on the farmer and part of it was a tax on the foreign buyer of the cotton because, as shown in Table 2.7, the GOE administered export prices were set above the prices of comparable competing grades and types of Egyptian cotton.

Table 2.5. Export tax on cotton varieties, 1986-1991.*

Variety	1986	1987	1988	1989	1990	1991
			(L.E./Seed Kentar)			
Giza 45	371.40	516.20	729.10	607.70	607.70	202.25
Giza 76	368.90	595.40	825.30	796.40	796.20	289.89
Giza 70	414.20	588.50	762.30	846.00	641.20	246.49
Giza 77	394.80	607.80	786.70	778.30	664.90	286.25
Giza 75	297.10	458.10	557.60	518.80	409.60	157.47

* Defined as the difference between the GOE export price and the farm procurement price (computed border price in Table 2.4 minus farm procurement price from Table 2.2.)

Table 2.6. Farm procurement prices as a percent of border prices, 1986-1991.

Variety	1986	1987	1988	1989	1990	1991
Giza 45	25	24	23	33	38	49
Giza 76	24	17	15	21	27	52
Giza 70	21	17	16	20	29	55
Giza 77	21	15	15	21	27	51
Giza 75	26	18	19	27	37	64

Competitive world prices:

The major competing varieties for Egyptian cotton are US Pima, Sudan Barakat, and SJV (San Joaquin Valley) California. The ratios of prices for these varieties during 1986-1991 are reported in Table 2.7. These data indicate that the export prices of Giza 70 set by the GOE were generally higher than competing varieties during this period. The difference during the period 1986-1991 was an average of 59 percent above the world price for US Pima and 84 percent above the world price for Sudan Barakat. Giza 75, the major Egyptian long staple variety, was priced an average of 90 percent above the SJV California, and 68 percent above Sudan Barakat during this same period.

Table 2.7. Ratios of export prices to several competing types of cotton during 1986/87-1991/92.

Year	Giza 70 vs. Barakat	Giza 70 vs. US Pima	Giza 75 vs. Barakat	Giza 75 vs. SJV Calif.
1986/87	1.30	1.30	1.62	1.52
1987/88	1.41	1.41	1.57	1.29
1988/89	1.30	1.30	1.49	2.29
1989/90	2.27	2.27	1.78	2.14
1990/91	2.80	1.82	2.00	1.91
1991/92	1.97	1.46	1.47	1.76
Average	1.84	1.59	1.68	1.90

Source: Egyptian Cotton Authority.

By setting the export prices for Egypt's cotton far above the prices of competing varieties during this period the GOE captured a temporary profit but this practice has also resulted in declining Egyptian cotton exports. The GOE reduced export prices recently, beginning in 1992/93 and especially in 1993/94, in response to falling world prices and in attempts to regain the market share it had lost through its high price policy.

Thus, returning to the question of export tax discussed above, if the export tax is defined as the difference between the farmer procurement price and the equivalent world market price, a different set of estimates of export taxes will result. Table 2.8 presents a set of calculations of the export tax for two common Egyptian cotton varieties, Giza 70 and 75, comparing the farmer procurement price to comparable US cotton varieties.

Table 2.8. Computation of export tax based on estimated world market value, 1986-1991.*

Variety	1986	1987	1988	1989	1990	1991
			(L.E./Seed Kentar)			
Farm procurement price						
Giza 70	108	117	147	216	256	306
Giza 75	105	100	131	191	237	277
Estimated border equivalent based on world market value						
Giza 70	361	493	739	422	516	401
Giza 75	249	422	275	307	317	228
Economic export tax						
Giza 70	253	377	592	207	260	95
Giza 75	144	323	144	117	80	-49
Farm procurement price as a percent of border price						
Giza 70	30	24	20	51	50	76
Giza 75	42	24	48	62	75	121

This comparison shows a much smaller gap between the farm procurement prices and world market prices but still a sizable export tax existed prior to 1991. In 1991 the farm procurement price of Giza 75 was set above its estimated world market value.

Cotton Exports:

During the period 1980/81-1992/93, all ELS varieties were exported but the volume of exports decreased from 302,000 Egyptian bales in 1980/81 to 28,567 bales in 1992/93 (Table 2.9). Exports of all cotton varieties slipped badly between 1987/88 and 1992/93 which prompted the decrease in export prices. Giza 75 was the only LS variety with any volume of exports until 1993/94. Exports of Giza 75 had decreased from 202,830 bales in 1985/86 to 24,326 bales in 1992/93 as shown in Table 2.10.

Exports rebounded sharply in 1993/94 primarily as a result of lower administered cotton export prices but also due to rising world demands. In 1993/94 we see the advent of two new LS varieties in the export trade, Giza 80 and Giza 83.

Significant quantities of exports of ELS varieties were made to 27 countries in 1986 which shrunk to 11 countries in 1992/93 (Table 2.11). The major importers of Egypt's ELS varieties in 1989/90 were USSR, Japan, and Czechoslovakia which together purchased 63,000 bales. But by 1992/93 sales to these three countries had slipped by 90 percent to only 6,600 bales.

Table 2.9. Exports of ELS Egyptian cotton varieties (1980/81 - 1993/94).

Years	Giza 45	Giza 76	Giza 70	Giza 77	Total
		1000 Egyptian Bales(6.53 M.C.)			
1980/81	16.7	---	284.9	---	301.6
1981/82	13.9	4.4	206.8	12.9	238.0
1982/83	31.1	1.0	176.9	31.8	241.9
1983/84	9.1	3.5	153.3	61.4	227.3
1984/85	12.0	7.9	120.8	113.9	254.6
1985/86	12.0	13.6	50.6	129.2	205.5
1986/87	8.9	25.9	19.0	130.4	184.2
1987/88	8.3	20.8	37.0	87.1	153.2
1988/89	6.5	14.9	25.6	70.1	117.0
1989/90	4.1	10.3	27.2	57.5	99.0
1990/91	3.5	4.3	10.7	21.5	40.1
1991/92	3.4	3.1	14.5	6.4	27.3
1992/93	2.6	4.5	13.4	8.1	28.6
1993/94	1.9	6.4	45.4	60.7	114.4

Source: Egyptian Cotton Gazette, July, 1994.

Table 2.10. Exports of LS Egyptian cotton varieties (1980/81 - 1993/94).

Years	Giza 69	Giza 67	Giza 75	Giza 81	Dandera	Giza 80 & 83	Total
			1000 Egyptian Bales(6.53 M.C.)				
1980/81	54.1	40.0	79.1	---	---	---	173.2
1981/82	72.7	20.0	192.6	---	---	---	285.3
1982/83	114.1	8.4	184.9	---	---	---	307.4
1983/84	77.4	---	190.4	---	8.1	---	275.9
1984/85	47.5	---	162.0	---	1.0	---	211.5
1985/86	45.0	---	202.8	---	0.1	---	247.8
1986/87	38.2	---	148.9	0.3	---	---	187.4
1987/88	20.7	---	90.4	0.7	---	---	115.6
1988/89	10.4	---	55.9	0.4	---	---	66.8
1989/90	2.7	---	29.8	---	---	---	32.5
1990/91	---	---	14.5	0.4	---	---	15.0
1991/92	---	---	23.6	0.1	---	---	23.7
1992/93	---	---	24.3	---	---	---	26.8
1993/94	---	---	123.4	10.9	13.4	72.0	219.7

Source: Egyptian Cotton Gazette, July, 1994.

Exports of LS varieties were diversified among 23 countries in 1986/87 (Table 2.12) but between 1986 and 1992 Egypt completely lost its markets in twelve countries including large markets in Czechoslovakia, China, Hungary, Rumania, and Yugoslavia and also lost almost all of its market in Italy and Japan, formerly it's two major importers.

Table 2.11. Exports of Egyptian ELS cottons by countries of destination, 1986/87 - 1993/94.

Countries	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94
				(Egyptian bales)*				
Albania	1550	1149	---	---	---	---	---	---
Austria	462	815	839	1091	369	291	320	840
Bangladesh	---	---	---	---	---	---	---	1811
Brazil	---	---	---	---	---	---	---	638
Belgium	894	630	400	169	---	300	---	---
Bulgaria	7570	5332	1796	950	---	---	---	1209
China	1063	4230	2050	630	---	---	---	915
Czech.	34400	26234	16700	20000	---	---	560	3437
France	2711	2870	1950	3015	1588	2025	2775	5355
Germany, D.R	8620	4969	2000	3000	---	---	---	---
Germany, F.R	2607	2370	2470	800	900	188	3864	8171
Greece	3000	3190	3050	1640	2300	---	1353	1200
Holland	---	---	---	---	---	---	---	912
Hong Kong	935	---	---	---	---	---	---	---
Hungary	3390	2370	2743	445	---	---	---	200
India	---	---	---	---	---	---	---	25667
Indonesia	---	---	---	---	---	---	---	450
Ireland	---	---	---	---	---	---	---	534
Italy	19830	17149	13714	4235	1416	3006	2385	11147
Japan	33068	38101	33330	20852	10818	10710	6034	8731
Korea,D.P.	5010	2071	891	2101	---	---	---	---
Korea, Rep.	1868	3380	3131	3679	2434	3317	3335	15769
Macedonia	---	---	---	---	---	---	---	640
Poland	1550	---	1000	---	---	---	---	---
Portugal	2785	1784	1308	757	259	544	375	571
Romania	10000	8650	100	2600	1200	---	---	529
Slovenia	---	---	---	---	---	---	---	77
Spain	5720	3750	1855	1343	69	292	540	2725
Switzerland	5838	5472	4017	4113	3480	4526	3383	10944
Taiwan	---	---	---	---	---	---	---	1490
Thailand	175	---	150	110	---	---	377	3946
Turkey	3344	1832	551	2101	1217	1845	2775	5940
U.K.	6794	3766	2213	49	---	---	152	300
U.S.S.R.	15105	10765	14300	22300	13450	---	---	---
Yugoslavia	5061	1840	5596	1853	300	---	---	---
Others	677	507	576	732	306	236	337	228
Total	184265	153226	117030	99044	40106	27280	28567	114376

Source: Egyptian Cotton Gazette, July, 1994.
* Egyptian bales equal about 6.53 metric kentars.

One should note that Egypt's exports of ELS varieties and Giza 75 are widespread, over 28 or more countries. The export data show that markets that were lost because of poor export price policies during 1986/87 to 1992/93 were regained in 1993/94.

Table 2.12. Exports of Egyptian LS cottons by countries of destination, 1986/87 - 1993/94.

Countries	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94
				(Egyptian bales)*				
Albania	750	153	---	---	---	---	---	---
Bangladesh	---	---	---	---	---	---	---	2111
Belgium	275	---	---	---	---	---	---	---
Bulgaria	3040	500	---	---	---	---	---	---
China	10000	1060	1150	3445	---	---	---	4792
Czech.	10600	3767	3300	---	---	---	---	364
Finland	152	---	---	---	---	---	---	---
France	4871	31	---	---	296	---	451	377
Germany,D.R.	5120	1030	5019	---	---	---	---	---
Germany,F.R.	15134	8936	350	296	407	1754	7304	19956
Greece	4077	1350	---	520	---	1400	600	1600
Hungary	10135	5330	2062	1855	---	---	---	---
India	---	---	---	---	---	---	---	50277
Italy	44964	26612	9665	3665	1528	1547	2952	13802
Indonesia	---	---	74	---	---	---	---	19344
Japan	49685	31646	18713	7345	5275	8995	4239	10000
Korea D.P.	650	200	---	---	---	---	---	---
Korea Rep.	9236	3230	2330	3716	1430	7505	3886	17913
Pakistan	---	---	---	---	---	---	---	4000
Portugal	522	230	31	---	153	---	---	3854
Romania	4200	---	1625	---	---	427	---	1486
Slovenia	---	---	---	---	---	---	---	2655
Spain	2931	1302	1179	427	250	62	39	2433
Switzerland	1044	342	222	302	603	1476	---	21935
Taiwan	---	---	---	---	---	---	---	2424
Thailand	1350	830	950	1015	75	150	300	9828
U.K.	1177	216	153	58	---	---	75	141
U.S.A.	---	---	---	---	---	---	---	150
U.S.S.R.	---	22835	16900	8900	4850	---	---	---
Yugoslavia	22783	418	2186	814	74	77	---	---
Others	2821	2252	748	---	---	305	830	1244
Total	187404	112148	66694	32258	15041	23698	24326	219981

Source: Egyptian Cotton Gazette, January 1994.
* Egyptian bales equal about 6.53 metric kentars.

Deliveries to Domestic Cotton Mills:

Mills receive cotton from domestic production and from imports. Total domestic deliveries to mills remained quite stable over this 8 year period (Table 2.13). Domestic deliveries of ELS varieties to mills ranged from 521,000 metric kentars in 1986/87 to 1,520,000 metric kentars in 1991/92 while the deliveries of LS varied between 5,189,000 metric kentars in 1986/87 to 3,755,000 metric kentars in 199/92. It is apparent that the domestic mills have a fairly constant demand for raw cotton and can utilize either ELS cottons or LS cottons. But indications are that domestic mills do not make full utilization of ELS varieties.[2] It is obvious that if the government of Egypt were to adopt policies to export ELS varieties at competitive prices and import medium staple cotton for the domestic mills, the added value of cotton to the GNP would increase and also increase revenues to both mills and exporters.

Table 2.13. Cotton mill deliveries by variety, 1985/86 - 1992/93.

Variety	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93
Extra Long				1000 M. Kentars				
Giza 45	0.1	23	8	3	11	5	4	2
Giza 76	6	48	59	62	100	56	170	146
Giza 70	394	539	339	434	419	477	605	384
Giza 77	121	395	302	370	496	432	740	192
Total	521	1006	708	869	1025	970	1520	724
Long								
Giza 69	85	160	253	124	188	9	---	---
Giza 75	3328	2891	2706	2627	2470	2695	2416	3504
Dandera	1170	934	815	446	472	491	531	459
Giza 80	487	542	489	439	507	551	510	695
Giza 81	119	99	439	469	291	301	298	252
Total	5189	4625	4703	4204	3928	4046	3755	4957
Total	5710	5631	5411	5073	4953	5017	5323	5681
Imports	617	296	627	613	1146	1030	1260	730
Grand Total	6327	5927	6038	5686	6099	6047	6583	6411

Source: Egyptian Cotton Authority.

---

2. See "Assessment of Potential for Liberalization and Privatization of the Egypt cotton Textile Subsector" Report to USAID/Cairo by Chemonics International, July 1993. Especially see Section IV on Technical Assessment.

Cotton Imports:

Cotton imports mainly come from Sudan and U.S.A. and started in 1974. During the period 1974 - 1990, the volume of cotton imports increased from 90 in 1974 to 1080 in 1990. Majority of imports come from U.S. as shown in Table 2.14.

Medium staple cottons are imported mainly from the USA and the Sudan who both fulfill the technical requirements set by MALR which stipulate that imported cotton be spun by mills situated outside the Egyptian cotton production areas. This accounts for the spinning of imported cotton in Alexandria, Helwan and Suez. The technical conditions include: a) vacuum fumigation of imported cotton bales at ports of exportation under the supervision of MALR technical staff so as to prevent the probable entry of cotton pests not present in Egypt. b) confining the importation of U.S. cotton from California and Arizona, both being free from boll weevil (Anthonomus gradis), and c) conducting laboratory tests at ports of arrival to confirm that imported cottons are free from viscosity.

Table 2.14. Egyptian cotton imports by country of origin, (1974/75 - 1991/92).

Year	Country of origin		
	USA	Sudan	Total
	(000) Metric Kentars		
1974/75	90.0	---	90.0
1975/76	---	---	---
1976/77	495.0	---	495.0
1977/78	265.5	---	265.5
1978/79	436.5	---	436.5
1979/80 through 1983/84			None
1984/85	616.1	---	616.1
1985/86	591.0	25.8	616.8
1986/87	296.5	---	296.5
1987/88	609.4	17.5	626.9
1988/89	613.4	---	613.4
1989/90	1,137.8	8.0	1,145.8
1990/91	1,029.8	---	1,029.8
1991/92	1,260.0	---	1,260.0
1992/93	730.0	---	730.0

The importable cotton quantities are determined by the operating capacities of the Egyptian spinning mills at the above-cited locations, whether those mills are owned by the public or the private sector.

CHAPTER III. THE USE OF LABOR IN COTTON PRODUCTION

Labor is one of the most important factors of production in agriculture, the others being land and capital. The availability of skillful labor has become a determinant factor in the agricultural development in Egypt which is currently encountering labor - related problems.

Characteristics of the Agricultural Labor Force:

1. Continual outflow of the permanent agricultural Labor.
2. Indivisibility of labor service units.
3. Diversity and lack of specialization except in certain limited fields.
4. Seasonality and lack of harmony in labor pattern.
5. Lack of adequate control during performance of the agronomic practices.
6. Seasonality of demand for agricultural labor throughout the crop year as compared to the relatively stable demand for labor in non-agricultural sectors.

Current Situation of Agricultural Labor:

The population of a country is the major source of its productive labor force. But the distribution of labor into the various sectors of the economy depends largely on the economic, demographic and social properties of the labor force.

Supply of Agricultural Labor:

The data in Table 3.1 indicate that the size of male labor force in agriculture has increased from 4,064,000 in 1986 to 4,208,000 laborers in 1991. The annual rate of growth is estimated by CAPMAS at 3.5 percent. With regard to women' labor force in the agricultural sector, it increased from 125,000 women workers in 1986 to about 130,000 in 1991 with a rate of growth of approximately one thousand women workers annually. Similarly, children' labor force within the sector was estimated to increase at 0.7 percent annually.

In the non-agricultural sectors, the male labor force increased at a rate of 4.2 percent, women with an annual rate of increase of 3.1 percent and children at a rate of 7.3 percent during the period from 1986 to 1991. During this period the share of the total labor force located in agricultural has declined. For men, this decline was from 40.4 percent in 1986 to 37.4 percent in 1991. The higher rate of increase in the non-agricultural sector and relative decline in the agricultural sector is due to the migration from rural areas to urban areas.

Table 3.1. Labor force in agricultural and non-agricultural sectors. (1986-91)

Year	Men	Women	Children	Total
Agricultural Sector				
1986	4,064	125	344	4,533
1987	4,093	126	346	4,565
1988	4,121	127	349	4,597
1989	4,150	128	351	4,629
1990	4,178	129	354	4,661
1991	4,208	130	356	4,694
Non-Agricultural Sectors				
1986	5,984	1,052	156	7,192
1987	6,246	1,085	169	7,500
1988	6,519	1,119	180	7,818
1989	6,798	1,154	194	8,146
1990	7,088	1,190	206	8,484
1991	7,384	1,227	221	8,832
National Economy				
1986	10,048	1,177	500	11,725
1987	10,339	1,211	515	12,065
1988	10,640	1,246	529	12,415
1989	10,948	1,282	545	12,775
1990	11,266	1,319	560	13,145
1991	11,592	1,357	577	13,526

Source: CAPMAS

Generally speaking, the agricultural labor supply is the function of the volume rural population real wage of the laborer in both the agricultural and the non-agricultural sector, in addition to the impact of legislations and policies within the agricultural sector.

Demand for Agricultural Labor:

The demand for agricultural labor depends on:

- Daily wage of the agricultural laborer.
- Value of the agricultural output.
- Capital requirements of production.
- The implemented cropping pattern.
- The cultivated area and farming activities.
- Economic and price policies within the agricultural sector.
- The prevailing level of applied technology in agriculture.
- The laborer's preference between wages and leisure time.

Table 3.2 indicates that the average monthly employment of men in agriculture in 1991 was estimated at about 58.4 million working days as compared to 27.2 and 13.5 million working days for women and children respectively. It is also apparent that the intensive employment of the male labor force was during the months of May and June (88.2 & 73.4 million working days respectively) which coincides with the harvesting season of winter crops and preparation for summer crops. The use of women's labor reached its peak in June, July and September (33.5, 34, 34 million working days respectively) mostly for livestock production and partly for harvesting winter crops and cotton picking. The use of child labor reached its peak level of employment in June and September (37.7 & 23.7 million working days) which reflects the use of child labor for the cotton worm control programs and cotton picking.

These data indicate that in 1991 plant production in total required 60.1%, 29% and 82.2% of the total agricultural need for the three categories of agricultural labor. These data also show that plant production depends largely on the labor of men and children while livestock production depends on the labor of women. However, the requirements for women's labor is greater for cotton, per feddan, (see Table 3.3) than for any other crop except sugarcane and in total is a major user of women's labor.

Table 3.2. Total demand for agricultural labor during 1991.

Month	Crop Requirements			Livestock Requirements			Total Requirements		
	Men	Women	Child.	Men	Women	Child.	Men	Women	Child.
	(Millions of Days)								
Nov.	26.8	6.3	8.0	18.9	18.9	1.7	45.7	25.2	9.7
Dec.	29.2	5.0	6.0	23.2	21.5	1.7	52.4	26.5	7.7
Jan.	26.9	4.4	6.0	29.2	22.3	3.4	56.1	26.7	9.4
Feb.	33.2	5.6	7.2	28.3	21.5	3.4	61.5	27.1	10.6
Mar.	25.0	3.8	4.0	30.1	23.2	3.4	55.1	27.0	7.4
Apr.	46.5	4.0	4.5	29.2	22.3	3.4	75.7	26.3	7.9
May	61.6	4.2	13.7	26.6	22.3	3.4	88.2	26.5	17.1
June	52.8	14.6	36.0	20.6	18.9	1.7	73.4	33.5	37.7
July	25.9	16.0	16.2	20.6	18.0	1.7	46.5	34.0	17.9
Aug.	25.6	5.0	4.0	20.6	15.5	1.7	46.2	20.5	5.7
Sept.	26.7	20.3	22.0	16.3	13.7	1.7	43.0	34.0	23.7
Oct.	40.6	5.7	6.0	16.3	13.7	1.7	56.9	19.4	7.7
Total	420.8	94.9	133.6	279.9	231.8	28.9	700.7	326.7	162.9
Percent	60.1	29.0	82.2	39.9	71.0	17.8	---	---	---

Source: CAPMAS & U/AES.

Cotton is the most labor intensive crop, next to sugarcane, in terms of man-days per feddan. It is estimated that in 1991 cotton production required 7% of the man labor, 15.6% of the woman labor and 20.8% of the total child labor employed in the agricultural sector. In relation to total plant production alone these percentages almost doubled (12%, 51% and 25% of the total men, women and children labor force employed in plant production).

Table 3.3. Requirements of crops for labor of men, 1990.

Crops	Months & Requirements												
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
	(man-days per feddan)												
L. Berseem	3	2	3	3	3	3	4	5	---	---	---	---	26
S. Berseem	3	4	4	4	---	---	---	---	---	---	---	---	15
Wheat	2	2	1	1	1	1	5	6	---	---	---	---	19
Barley	2	2	1	1	1	1	5	5	---	---	---	---	18
Fava Beans	2	1	1	2	1	4	4	---	---	---	---	---	15
Lentils	2	2	1	3	4	3	4	---	---	---	---	---	19
Legumes	6	6	4	4	6	7	7	---	---	---	---	---	40
Flax	4	4	5	4	4	6	7	---	---	---	---	---	34
Wint.Onion	4	3	3	2	3	3	3	---	---	---	---	---	21
Wint.Tomato	8	6	6	6	10	10	---	---	---	---	---	---	46
Wint.Veget.	5	4	3	4	4	3	3	3	---	---	---	---	29
Cotton	---	---	---	---	6	6	4	4	4	5	10	10	49
Rice	---	---	---	---	---	---	---	---	10	5	5	10	30
Summer Maize	---	---	---	---	---	---	---	---	5	4	4	9	22
Sorghum	---	---	---	---	---	---	---	6	6	4	7	7	30
Soyabeans	---	---	---	---	---	---	---	---	4	4	6	6	20
Groundnuts	---	---	---	---	---	---	---	6	7	7	10	11	41
Sesame	---	---	---	---	---	---	---	6	6	4	6	6	28
Sum. Potato	---	---	---	---	---	---	---	---	6	7	6	8	37
Sum. Tomato	---	---	---	---	---	---	---	---	10	8	12	10	40
Sum. Veget.	---	---	---	---	---	---	---	---	6	5	4	8	23
Nile Maize	---	---	---	---	---	---	---	---	4	4	4	8	20
Sugarcane	8	8	9	8	9	9	10	7	7	10	7	6	98
Citrus	3	3	3	3	3	3	2	3	3	3	3	3	35

Source: U/AES

Table 3.4. Requirements of crops for labor of women, 1990.

Crops	Months & Requirements												
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
	(woman-days per feddan)												
L. Berseem	2	2	2	2	3	2	5	5	---	---	---	---	23
S. Berseem	3	3	4	4	---	---	---	---	---	---	---	---	14
Wheat	2	1	1	1	1	1	5	5	---	---	---	---	17
Barley	1	---	1	1	---	---	---	---	---	---	---	---	3
Fava Beans	3	2	1	1	1	1	3	---	---	---	---	---	12
Lentils	---	---	---	---	1	1	6	---	---	---	---	---	8
Legumes	5	4	3	3	3	5	---	---	---	---	---	---	23
Flax	2	1	1	1	2	2	5	---	---	---	---	---	14
Wint.Onion	4	4	3	3	2	2	---	---	---	---	---	---	18
Wint.Tomato	4	3	6	6	6	---	2	---	---	---	---	---	29
Wint.Veget.	5	3	3	3	3	3	5	2	---	---	---	---	27
Cotton	---	---	---	---	5	6	5	3	4	4	12	12	51
Rice	---	---	---	---	---	---	---	---	5	3	2	5	15
Sum. Maize	---	---	---	---	---	---	---	---	3	5	4	9	21
Sorghum	---	---	---	---	---	---	---	---	1	1	1	2	5
Soyabeans	---	---	---	---	---	---	---	---	1	1	1	3	6
Groundnut	---	---	---	---	---	---	---	3	2	2	4	4	15
Sesame	---	---	---	---	---	---	---	---	---	1	1	2	4
S-Potato	---	---	---	---	---	---	---	---	3	2	4	4	13
S-Tomato	---	---	---	---	---	---	---	---	3	4	6	7	20
S-Veget	---	---	---	---	---	---	---	---	6	6	3	7	22
N-Maize	---	---	---	---	---	---	---	---	1	2	3	3	9
Sugarcane	1	2	1	1	2	1	1	2	1	1	1	2	16
Citrus	2	2	3	3	2	2	2	3	3	3	2	3	30

Source: U/AES

The requirements of cotton for labor are particularly large during three peak periods. During March and April large quantities of man labor is needed for preparation of the land for cotton planting and of women's labor for cotton planting. During July and August cotton requires large amounts of child labor for picking of boll worm eggs. During September and October there is a need for a large quantity of labor by women and children for cotton picking.

The July-August requirement for child labor for picking of worm eggs does not coincide with any other large crop labor requirement and thus does not likely compete with the production of other crops. However, the spring planting season and the fall cotton picking requirements come at the same time as large requirements for other crops and thus would be critical periods which would compete with other crops and would thus figure largely in farmers crop selection decisions.

Table 3.5. Requirements of crops for labor of children, 1990.

Crops	Months & Requirements												
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
	(child-days per feddan)												
L. Berseem	1	1	1	2	2	1	2	2	---	---	---	---	12
S. Berseem	1	2	2	1	---	---	---	---	---	---	---	---	6
Wheat	1	1	---	---	---	1	2	3	---	---	---	---	8
Barley	1	1	---	---	---	1	---	---	---	---	---	---	3
Fava beans	1	1	---	---	1	2	2	---	---	---	---	---	7
Lentils	---	---	---	---	1	1	---	---	---	---	---	---	2
Legumes	5	4	4	3	3	5	6	---	---	---	---	---	30
Flax	2	1	1	1	1	2	---	---	---	---	---	---	8
Wint.Onion	2	2	2	1	1	1	2	---	---	---	---	---	11
Wint.Tomato	4	2	2	8	5	---	---	---	---	---	---	---	21
Wint.Veget.	2	1	1	1	1	1	1	2	---	---	---	---	10
Cotton	---	---	---	---	2	2	3	7	6	3	6	5	34
Rice	---	---	---	---	---	---	---	---	5	4	4	9	22
Sum.Maize	---	---	---	---	---	---	---	---	2	2	2	3	9
Sorghum	---	---	---	---	---	---	---	---	1	1	2	2	6
Soyabeans	---	---	---	---	---	---	---	---	1	2	2	3	8
Groundnut	---	---	---	---	---	---	---	3	3	4	5	5	20
Sesame	---	---	---	---	---	---	---	---	1	1	---	2	4
Sum.Potato	---	---	---	---	---	---	---	---	4	3	6	7	20
Sum.Tomato	---	---	---	---	---	---	---	---	4	4	6	7	21
Sum.Veget.	---	---	---	---	---	---	---	---	4	4	5	7	20
Nile Maize	---	---	---	---	---	---	---	---	1	1	2	3	7
Sugarcane	1	1	---	2	1	1	1	2	2	1	2	1	15
Citrus	1	1	1	1	1	1	1	2	2	1	1	2	15

Source: U/AES

Wages in The Agricultural Sector:

Wages in the various sectors of the national economy are instrumental in the inter-sectoral allocation of human resources. The economic rule that govern this process is the resource efficient employment within a given sector until the value of marginal product equates the wage per unit.

The data in Table 3.6 show that wages in the agricultural sector have not kept pace with the other sectors of the national economy. The average annual increment in wages over the period from 1981 to 1991 was estimated at L.E. 2,427 millions. In the non-agricultural sectors it was estimated at L.E. 2,099 million while in the agricultural sector the estimated figure did not exceed L.E. 329 millions. The same measure applies to the average daily wage of the agricultural and non-agricultural laborer (L.E. 5.8 and 11.3 respectively) in 1991. This accounts for the apparent change in the overall structure of labor distribution among the various sectors of the national economy in

favor of those sectors characterized by relatively higher wages. As a result, the comparative importance of the agricultural labor force declined despite the recorded increase in its absolute values.

Table 3.6. Total wages In Egypt,(1981 - 1991).
(Millions of workers and Million LE)

Year	National Level		Agric. Sector		Non-Agr.Sector	
	No. Workers	Wages	No. Workers	Wages	No. Workers	Wages
1981	10.52	9,971	4.10	1,898	6.42	8,073
1982	10.80	10,899	4.14	2,008	6.66	8,891
1983	11.07	12,120	4.19	2,135	6.88	9,985
1984	11.37	13,536	4.23	2,264	7.14	11,272
1985	11.67	14,873	4.28	2,404	7.39	12,469
1986	12.00	16,379	4.33	2,663	7.67	13,716
1987	12.35	19,617	4.38	3,116	7.97	16,501
1988	12.72	22,453	4.43	3,535	8.29	18,918
1989	13.09	25,820	4.48	4,000	8.61	21,820
1990	13.49	29,830	4.54	4,530	8.85	25,300
1991	13.90	34,247	4.59	5,186	9.31	29,061

Source: Ministry of Planning - Department of Employment.

Labor demand versus supply in the agricultural sector:

It is quite imperative to estimate the supply and demand for labor in order to determine the surplus or shortage in the agricultural labor force throughout the crop year (CY) for the various gender and age categories, in view of seasonality of the agricultural labor (see Table 3.7).

Estimates by CAPMAS of the labor force available differ quite drastically from the U/AES estimates of labor use in agriculture in regard to the labor of women. It is obvious that the CAPMAS estimates underestimated the amount of labor available. Such labor could not be used if it was not available.

These estimates do highlight the fact that the Egyptian Agriculture is currently facing a problem of seasonal employment. However, the severity of the problem varies from one month to another in relation to the need for labor in the various farming activities.

Table 3.7. Supply and demand of agricultural labor force, 1991.

Month	Available Labor Working Days			Labor Used Working Days			Surplus Labor Working Days		
	Men	Women	Child.	Men	Women	Child.	Men	Women	Child.
	(Million Working Days).								
Nov.	87.7	2.2	7.4	45.7	25.2	9.7	42.0	-23.0	-2.3
Dec.	87.7	2.2	7.4	52.4	26.5	7.7	35.3	-24.3	-0.3
Jan.	87.7	2.2	7.4	56.1	26.7	9.4	31.6	-24.5	-2.0
Feb.	87.7	2.2	7.4	61.5	27.1	10.6	26.2	-24.9	-3.2
Mar.	87.7	2.2	7.4	55.1	27.0	7.4	32.6	-24.8	0.0
Apr.	87.7	2.2	7.4	75.7	26.3	7.9	12.0	-24.1	-0.5
May	87.7	2.2	7.4	88.2	26.5	17.1	-0.5	-24.3	-9.7
June	87.7	2.2	7.4	73.4	33.5	37.7	14.3	-31.3	-30.3
July	87.7	2.2	7.4	46.5	34.0	17.9	41.2	-31.8	-10.5
Aug.	87.7	2.2	7.4	46.2	20.5	5.7	41.5	-18.3	1.7
Sept .	87.7	2.2	7.4	43.0	34.0	23.7	44.7	-31.8	-16.3
Oct.	87.7	2.2	7.4	56.9	19.4	7.7	30.8	-17.2	-0.3
Total	1052	26	89	700.7	326.7	162.9	351.3	-300.7	-73.9

Source: (1) Available Labor Force from CAPMAS. (2) Labor Force use from U/AES.

CHAPTER IV. COST OF PRODUCTION SURVEYS

This chapter contains a description of data obtained from surveys of production practices and costs for cotton, maize, short season berseem, long season berseem, wheat fava beans and rice although the data on rice costs were collected in a separate survey. These data represent production during the summer cropping season of 1991 and the winter cropping season of 1991-92.[1]

Sampling

The data reported here were gathered to study the possible response by farmers in the area planted to cotton to price and policy changes. Since cotton is a major export crop, the study areas were stratified on the basis of the variety of cotton produced as follows: 1) areas producing extra long staple (ELS) varieties (Giza 45, 70, 76 and 77), 2) areas which produce Giza 75, the major exported long staple (LS) variety, and 3) areas producing other long staple varieties (Giza 80, 81 and Dandera). All survey sampling, and data summary, for all crops (except rice) were performed on the basis of these these three major categories.

Total sample sizes were 750 for cotton and 300 for each of the other crops. The sample of 750 cotton producers was apportioned between varieties and governorates in proportion to the 1991 area of cotton production. Thus, the sample consisted of 225 producers of ELS cotton in the governorates of Behira, Kafr El Sheikh, and Damietta, 357 producers of variety Giza 75 in Gharbiya, Daqahliya, Sharquia, and Beni Suef, and 168 producers of other LS varieties from Sharquia, Minya and Assuit. As indicated, 47.6 percent of the sample was of producers of Giza 75. This variety represented 46.2 percent of the total cotton area in 1991. The sample for the other crops was distributed in these same governorates in the same proportions.

---

1. The data files for all crops except rice are in Lotus, 1-2-3. There 30-50 data files for each crop. A list of the data files and a description of the data is given in Word Star 2000 on the data diskettes. The diskettes also contain some summary files which include the same types of data as provided in the tables of this report but summarized by governorate for each crop. Data diskettes are available through APCP or USAID/Cairo.

Questionnaires

An English translation of the questionnaire used for cotton is enclosed in Annex II. The questionnaires for other crops were similar but with two exceptions: 1) the list of cropping operations was tailored to fit the individual crop, and 2) questions were added to the section on Crop History in the survey of winter crops to obtain data on secondary products of all crops. Data on secondary products were obtained not only for the 1991-92 winter crops but also for the preceding summer crops, i.e. cotton, maize, and rice. This includes cotton, maize and fava bean stalks, wheat and rice straw, and seed in the case of long season berseem. Short berseem has no secondary product.

Enumeration

The data for the two summer crops, cotton and maize, were collected during March, 1992. The data for the winter 1991-92 crops (wheat, fava beans and both types of berseem) were collected during June of 1992. The sample was drawn, and the field enumeration and computer data entry was performed by staff of the Economic Affairs Sector of the MALR.

Land use on sample farms

Tables 4.1-4.3 include summaries of survey data obtained on land use on the sample farms. These data illustrate two major points: 1) most farms produce only 1-3 major crops per season, and 2) this survey sampled all of the major crops with the exception of rice. Data were collected on costs of producing rice in a separate study which has also been summarized in this report.

The land use data illustrate that wheat and berseem occupy 85-90 percent of the total cropland in winter crops in the areas producing ELS cotton varieties and Giza 75. Fava beans is an important additional crop in the areas where the other LS cotton varieties are grown. Thus, the four winter crops surveyed cover 90 to 95 percent of the land in crops in the cotton producing areas. This illustrates that vegetable and fruit crops, which are often cited as major cropping alternatives to cotton are really not major uses of crop land in the cotton areas.

In the case of the summer season crops, cotton, maize and rice accounted for 95-97 percent of the cropland on the surveyed farms in the ELS and Giza 75 producing areas. In the areas producing other LS varieties these three crops accounted for slightly less than 70 percent of the cropland since rice is not commonly grown in these areas. The other LS varieties are generally produced in Middle and Upper Egypt where sorghum is an important crop.

In all study areas, the percent of land devoted to short berseem decreased between the two winter seasons but off setting this were increases in the percent of land devoted to wheat and long berseem. The shift from short berseem to long berseem reflects and is associated with a decline in cotton area planted in 1992 compared with 1991. However, these data probably do not indicate any long term trends in crop areas but are a short term phenomena reflecting price and profit expectations for crops.

Table 4.1. Land use on sample farms in governorates producing ELS cotton varieties.

Season and Crop	Units	Behira	Kafr El Sheikh	Damietta	Total
Winter 1990-91 Crops					
Wheat	Feddan	1.34	1.05	0.98	1.17
	Percent	30.63	32.63	17.09	26.72
Short Berseem	Feddan	1.60	1.37	2.40	1.73
	Percent	36.53	42.58	41.78	39.50
Long Berseem	Feddan	1.35	0.65	1.87	1.27
	Percent	30.79	20.26	32.54	29.11
Fava beans	Feddan	---	0.02	0.34	0.09
	Percent	---	0.48	5.86	1.98
Other crops	Feddan	---	0.13	0.16	0.08
	Percent	---	4.05	2.73	1.74
Uncultivated	Feddan	0.09	---	---	0.04
	Percent	2.06	---	---	0.96
Summer 1991 Crops					
Cotton	Feddan	1.58	1.42	2.38	1.73
	Percent	36.20	44.01	41.37	39.52
Maize	Feddan	0.91	0.41	0.51	0.67
	Percent	20.82	12.79	8.89	15.28
Rice	Feddan	1.78	1.34	2.31	1.78
	Percent	40.60	41.53	40.17	40.66
Other crops	Feddan	---	0.05	0.44	0.12
	Percent	---	1.67	7.66	0.09
Uncultivated	Feddan	0.10	---	0.11	0.08
	Percent	2.38	---	1.90	1.72
Winter 1991-92 Crops					
Wheat	Feddan	1.43	1.15	1.30	1.32
	Percent	32.62	35.57	22.67	30.06
Short berseem	Feddan	1.41	0.58	1.18	1.12
	Percent	32.29	18.09	20.56	25.51
Long Berseem:	Feddan	1.42	1.07	2.38	1.56
	Percent	32.42	33.25	41.52	35.51
Other crops:	Feddan	0.02	0.41	0.68	0.19
	Percent	0.00	12.85	11.45	5.64
Uncultivated	Feddan	0.09	0.01	0.22	0.10
	Percent	2.17	0.24	3.80	2.28
Total Land Held	Feddan	4.38	3.23	5.74	4.38

Table 4.2. Land use on sample farms in governorates producing cotton variety Giza 75.

Season and Crop	Units	Gharbiya	Daqah-liya	Beni Suef	Sharquia	Total Giza 75
Winter 1990-91 Crops						
Wheat	Feddan	0.59	1.31	0.78	2.92	1.42
	Percent	25.30	32.68	26.00	34.06	31.74
Short Berseem	Feddan	0.63	1.83	1.02	2.98	1.70
	Percent	26.98	45.47	34.05	34.77	38.10
Long Berseem	Feddan	0.38	0.63	0.47	1.88	0.81
	Percent	16.22	15.65	15.58	21.90	18.18
Fava beans	Feddan	0.03	0.01	0.51	0.52	0.20
	Percent	1.47	0.15	17.22	6.04	4.50
Other crops	Feddan	20.41	0.05	0.21	0.15	0.18
	Percent	45.22	1.26	7.15	0.23	4.06
Uncultivated	Feddan	0.22	0.19	---	1.79	0.15
	Percent	9.62	4.79	---	0.12	3.42
Summer 1991 Crops						
Cotton	Feddan	1.24	2.02	1.45	2.97	1.97
	Percent	53.45	50.31	48.53	34.64	44.22
Maize	Feddan	0.34	0.45	1.38	2.15	0.93
	Percent	14.67	11.12	46.29	25.07	20.89
Rice	Feddan	0.61	1.48	---	3.18	1.42
	Percent	26.30	36.74	---	37.09	31.77
Other crops	Feddan	---	0.03	0.15	0.14	0.07
	Percent	0.02	0.62	5.18	1.63	1.47
Uncultivated	Feddan	0.13	0.05	---	0.13	0.07
	Percent	5.49	1.21	---	1.57	1.65
Winter 1991-92 Crops						
Wheat	Feddan	1.09	1.91	0.91	3.13	1.84
	Percent	46.71	47.61	30.61	36.45	41.22
Short Berseem	Feddan	0.25	0.99	0.48	2.56	1.08
	Percent	10.68	24.56	16.03	29.88	24.33
Long Berseem	Feddan	0.69	0.87	0.74	2.05	1.06
	Percent	29.51	21.78	24.87	23.93	23.76
Other crops	Feddan	0.18	0.15	0.83	0.47	0.24
	Percent	7.61	3.73	27.60	5.44	5.48
Uncultivated	Feddan	0.13	0.09	0.03	0.36	0.24
	Percent	5.49	2.31	0.90	4.29	5.48
Total Land held	Feddan	2.32	4.02	2.99	8.58	4.46

Table 4.3. Land use on sample farms in governorates producing other LS cotton varieties (excluding Giza 75).

Season and Crop	Units	Minya	Assuit	Sharquia	Total
Winter 1990-91 Crops					
Wheat	Feddan	0.50	2.12	2.92	1.35
	Percent	28.10	30.63	34.06	32.12
Short Berseem	Feddan	0.53	0.26	2.98	0.60
	Percent	29.83	3.77	34.77	14.27
Long Berseem	Feddan	0.14	0.94	1.88	0.58
	Percent	7.93	13.63	21.90	13.82
Fava Beans	Feddan	0.53	1.86	0.52	0.93
	Percent	29.79	26.86	6.04	22.00
Other crops	Feddan	0.08	1.68	0.15	0.71
	Percent	4.36	24.33	0.23	16.80
Uncultivated	Feddan	---	0.05	1.79	0.04
	Percent	---	0.79	0.12	0.99
Summer 1991 Crops					
Cotton	Feddan	0.99	2.28	2.97	1.59
	Percent	56.04	32.95	34.64	37.83
Maize	Feddan	0.72	1.54	2.15	1.06
	Percent	40.66	22.20	25.07	25.17
Rice	Feddan	---	---	3.18	0.26
	Percent	---	---	37.09	6.23
Other crops	Feddan	0.06	2.86	0.14	1.18
	Percent	3.30	41.34	1.63	27.96
Uncultivated	Feddan	---	0.24	0.13	0.12
	Percent	---	3.51	1.57	2.81
Winter 1991-92 Crops					
Wheat	Feddan	0.76	2.06	3.13	1.43
	Percent	43.17	29.73	36.45	34.06
Short Berseem	Feddan	0.05	0.81	2.56	0.51
	Percent	2.79	11.76	29.88	12.00
Long Berseem	Feddan	0.54	1.12	2.05	0.91
	Percent	30.42	16.17	23.93	21.58
Other crops	Feddan	0.40	2.76	0.70	1.27
	Percent	22.77	39.95	8.18	30.17
Uncultivated	Feddan	0.02	0.17	0.13	0.09
	Percent	0.86	2.39	1.57	2.18
Total land held	Feddan	1.77	6.91	8.58	4.21

Livestock on sample farms

Livestock inventory data were obtained to allow study of the relationships between livestock inventories and crop production (Tables 4.4-4.7). These data were not used in estimating the crop production costs. In this study all costs of animal power were based on hired rates. But it is interesting to note that animal costs represent a very small portion of crop production

costs for all crops. And furthermore, practically all animal costs reported were for transportation with practically no costs reported for draft purposes or for pumping of irrigation water. This illustrates the almost complete transition that has occurred in Egypt to tractor power tillage and diesel powered water pumping. For example, in Table 5.2 the animal costs reported for cotton averaged only LE 7.13 per feddan, and of this total LE 6.57 (92 percent) was for transportation costs. This leaves less than LE 1/feddan for pumping water with the saki water wheel or for any type of tillage with animal power.

The livestock inventory data exhibit a great degree of uniformity across governorates in the number and type of livestock found on farms. Throughout Egypt we usually find one donkey on each farm. We also find an average of one adult buffalo and one adult cow plus some young stock. Actually, farms usually do not have both buffalo and beef cows. One farm will have two milk cows and his neighbor will have two buffalo. Goats and sheep are also common throughout Egypt but are not distributed uniformly across farms. Some farms will have 8-10 sheep or goats while most farms have none. Ownership of camels on farms is becoming quite rare.

Table 4.4. Livestock on farms producing ELS varieties of cotton.

Type of livestock	Behira	Damietta	Kafr El Sheikh	Total ELS
		(No. head per farm)		
Buffalo: breeding age	1.27	1.18	1.02	1.17
Buffalo: young	0.79	0.55	0.37	0.61
Cattle: breeding age	1.44	1.22	1.25	1.33
Cattle: young	0.62	0.65	0.46	0.58
All donkeys	0.99	1.00	1.02	1.00
All goats	0.59	0.49	0.40	0.51
All sheep	1.21	0.76	0.72	0.96
All camels	0.02	0.00	0.02	0.01

Table 4.5. Livestock on farms producing Giza 75 cotton.

Type of Livestock	Gharbiya	Daqah-liya	Beni Suef	Sharquia	Total
		(No. head per farm)			
Buffalo: breeding age	1.17	0.89	0.30	1.26	0.92
Buffalo: young	0.61	0.43	0.09	0.39	0.40
Cattle: breeding age	0.68	0.46	1.05	1.47	0.76
Cattle: young	0.30	0.20	1.00	0.69	0.45
All donkeys	0.97	0.80	1.11	1.09	0.94
All goats	0.55	0.36	1.88	1.29	0.84
All sheep	0.30	0.46	0.91	1.61	0.74
All camels	0.02	0.01	0.04	0.01	0.01

Table 4.6. Livestock on farms producing other LS cotton varieties.

Type of livestock	Minya	Assuit	Sharquia	Total
		(No. head per farm)		
Buffalo: breeding age	1.25	0.83	1.02	1.02
Buffalo: young	0.63	0.72	0.62	0.66
Cattle: breeding age	0.72	0.83	0.76	0.77
Cattle: young	0.45	0.51	0.64	0.52
All donkeys	1.07	1.29	1.06	1.16
All goats	3.00	2.27	1.60	2.32
All sheep	2.93	2.05	1.10	2.08
All camels	0.12	0.01	---	0.04

Table 4.7. Livestock on all sample farms.

Type of livestock	ELS	Giza 75	Other LS	Total
		(No. head per farm)		
Buffalo: breeding age	1.17	0.92	1.02	1.02
Buffalo: young	0.61	0.40	0.66	0.53
Cattle: breeding age	1.33	0.76	0.77	0.94
Cattle: young	0.58	0.45	0.52	0.51
All donkeys	1.00	0.94	1.16	1.01
All goats	0.51	0.84	2.32	1.11
All sheep	0.96	0.74	2.08	1.14
All camels	0.01	0.01	0.04	0.02

Labor use on sample farms

Data were obtained from the survey on the days of labor of men, woman and children, divided by hired and family, and for each major operation. Also, the wage rate was obtained for each category of labor for each operation. Thus, this data set could be used to calculate the percent of labor cost for each operation that is hired versus the percent of family labor, and what portion of each operation is done by men, women or child.

In summarizing the labor data for crop budget purposes, costs of labor were first estimated by multiplying the quantities of labor reported for each category of labor (man, women and child) and by operation, by the reported wage rates. In this calculation the hired wage rate was applied to both family and hired labor. This gave an estimate of total labor cost for each operation. Then the total labor cost was divided by the average wage rate for men to give an estimate of total man-day equivalents. This was done to give an estimate of the physical quantity of labor and thus to provide a procedure for updating labor costs at a later date. This procedure does not imply that all labor is performed by men. Some specific crop production tasks are primarily performed by men and others by women or children.

The cost budgets included in this report do not present a full analysis of these data labor but were used only to estimate costs of production and for comparisons of returns between the various crops and rotations. Many other types of analyses could be performed with these data.

Table 4.8 illustrates one other possible calculation with the data on labor use for cotton production. Gharbiya was selected at random for this demonstration. These data indicate that the tasks of plowing, land leveling, and making rows was done entirely by men and 98 percent of the labor for irrigating was performed by men. However, 77 percent of the planting labor was done by women and 82 percent of this labor was hired.

Labor is a major cost item in producing most crops, not just cotton. For the entire sample here examined, labor represented 51 percent of total costs for cotton, 34 percent for maize, 25 percent for wheat, 24 percent for beans, 41 percent for long berseem, 33 percent for short berseem and 20 percent for rice. However, as shown below, these estimates do not include all labor used to harvest berseem since it does not include the harvesting of berseem that is sold standing in the field. Thus, the percentages given above are slightly low for the berseem crops but do represent the total cost to the farmer.

Table 4.8. Labor use by operation, cotton, Gharbiya.

Operation	Type	Family labor Days/FD	LE/Day	LE/FD	Hired Labor Days/F	LE/Day	LE/FD
Trans,& apply	Men	0.68	4.64	3.17	2.03	4.05	8.21
manure	Women	0.07	3.00	0.22	---	---	---
	Child	0.17	3.14	0.54	0.22	2.28	0.50
Plowing	Men	0.09	5.00	0.43	0.07	4.00	0.29
Land leveling	Men	0.12	4.30	0.52	0.11	3.67	0.40
Make rows	Men	0.07	5.00	0.37	0.13	3.73	0.50
Make ridges	Men	0.63	4.92	3.09	2.28	4.11	9.38
& lines	Women	---	---	---	0.04	3.00	0.11
Planting	Men	0.34	4.36	1.49	0.57	4.15	2.38
	Women	0.66	2.91	1.92	4.39	2.81	12.33
	Child	---	---	---	0.15	2.75	0.40
Irrigating	Men	2.96	4.79	14.20	2.35	4.50	10.59
	Child	---	---	---	0.29	2.00	0.59
Weeding	Men	1.10	4.56	5.00	2.86	3.97	11.32
	Women	0.33	3.37	1.11	3.53	2.83	9.97
	Child	0.57	2.72	1.56	1.55	2.57	3.99
Apply fert.	Men	0.61	4.46	2.72	0.45	3.73	1.68
	Women	0.21	2.76	0.57	1.11	2.75	3.05
	Child	0.32	2.00	0.63	1.73	2.18	3.78
Pick worm eggs	Men	0.02	5.00	0.37	---	---	---
	Child	0.79	1.00	0.79	15.62	1.06	16.53
Apply pest.	Men	0.17	4.43	0.76	0.52	4.67	2.45
(own program)	Child	0.16	1.00	0.16	0.23	0.68	0.16
Pick cotton #1	Men	1.50	3.52	5.29	4.98	3.17	15.76
	Women	0.76	3.12	2.36	16.83	3.02	50.83
	Child	0.41	3.24	1.34	10.44	2.73	28.53
Pick cotton #2	Men	0.90	3.72	3.36	0.72	3.53	2.54
	Women	0.35	3.03	1.07	6.81	3.05	20.79
	Child	0.24	2.96	0.72	4.05	2.88	11.65
Pick cotton #3	Men	0.02	4.25	0.10	---	---	---
	Women	0.01	2.50	0.03	0.11	3.11	0.34
	Child	---	---	---	0.02	4.00	0.10
Trans. cotton	Men	0.52	3.99	2.09	0.84	3.91	3.29
	Child	---	---	---	0.01	3.00	0.04
Cut stalks	Men	0.88	5.49	4.82	3.09	5.39	16.63
	Women	0.29	2.38	0.70	0.16	2.77	0.44
	Child	0.15	2.00	0.29	0.02	2.00	0.05
Trans. stalks	Men	0.11	3.67	0.40	0.06	4.00	0.24
	Child	0.39	2.00	0.78	0.48	2.00	0.95
Total costs	Men	10.74	4.78	48.18	21.07	4.04	85.68
	Women	2.68	2.88	7.98	32.97	2.92	97.87
	Child	3.21	2.23	6.82	34.82	2.32	67.27
	Totals			62.99			250.83
Grand total							313.81

These data (Table 4.8) show that the cost of picking cotton in Gharbiya in 1991 was LE 144.81/FD or 46 percent of the total labor cost of cotton. Of the picking cost, 51 percent was for hired women, and 28 percent for hired children. The cost of labor for cotton picking is the single largest cost item in the cotton cost budget. In total, 43 percent of the total labor costs was for man labor, 34 percent for women and 24 percent for children and in total, 80 percent of all labor was hired.

The average wage rates reported in Table 4.8 were LE 4.78/day for family man labor and LE 4.04/day for hired man labor. The average wage rates for women were reported as LE 2.88 and 2.92/day and LE 2.23 and 2.32 for children. Wage rates varied by task with the highest rate for cutting cotton stalks. The average wage rate for this task was higher than for other tasks in most governorates

These data provide a comparison or the wage rates of women and children to that of men. These ratios also vary widely by task, by area, and by crop. In Table 4.8 the wage rates for women averaged 60 percent of the wage rate for men for family labor and 72 percent of the man wage rate for hired labor. In the case of child labor, this ratio is 47 percent for the family labor reported and 57 percent for the hired labor. Although these data represent only labor use on cotton in one governorate, these ratios are quite representative of other crops and areas. Thus, for simplicity sake, the wage rate of women would be expected to be approximately two/thirds that for men and the wage rate for children would be about one half of the wage rate for men but recognizing that these ratios are highly variable.

The quantity of labor used is also highly variable between farms. For example, the amount of labor used for harvest can be easily varied from season to season depending upon the yield and the upon the price of the crop. More correctly, one can say that the labor cost will vary with yield but also, the yield will vary with the amount of labor used for picking. The number of times cotton is picked can quite easily be adjusted from season to season. For instance, the average number of pickings reported for the entire Republic was 1.5 times in 1991 compared to 2.18 times reported for 1992.[2] A high cotton price will encourage a farmer to put workers into the field an extra time to pick early or late opening bolls to increase production.

Adjusting cotton picking labor costs for yield could be done by simply computing an average picking cost per kentar. For example, dividing the average cotton picking cost of LE 144.81

---

2. See the Tranche V and VI reports of the MALR to USAID on the Agricultural Policy Reform Program of the Agricultural Production and Credit Project for 1991 and 1992.

(Table 4.8) by the average yield of 5.69 kentar gives LE 24.45 per kentar. This cost estimate per kentar would probably be more accurate than use of the average of LE 144.81 for all yield levels. It is expected that a thorough analysis of data for several years would show a fixed quantity for picking and a declining average per unit cost as yield increases.

Yields versus harvest labor requirements:

The large sample size of the cost of production surveys, and the detailed cost estimates by operation encouraged some statistical testing of certain relationships. The major interest was to try to determine if any relationship between yields and the requirement for harvest labor could be estimated. Since the farms in the sample used similar production technology which consists primarily of hand harvest of all crops, one would expect to find a close relationship between the yield (output/feddan) and the quantity of labor used for harvest. Estimates of the relationship between yield and harvest labor can be used to refine cost of production estimates as yields vary.

In this analysis, the yield is regarded as the independent variable and the amount of harvest labor is regarded as the dependent variable. To some extent, yield is a function of the amount of labor used. For example, with cotton, additional pickings would likely increase yield since three pickings would allow better timing of harvest with greater total yield and better cotton quality than would two pickings. On the other hand, the greater the number of bolls, the more picking time is required. So one can argue about which is the dependent variable and which is the independent variable but a correlation between the two variables would definitely be expected.

The labor variable used in these analysis is defined as man-day equivalents. This concept was defined above on page 9. The total cost of harvest labor was calculated for each farm and then divided by the wage rate for men to get a physical measure of labor. All operations related to harvest were included here from the cutting of the crop on the field, picking, threshing, cleaning grain, cleaning the field of straw or stalks and all transport of primary and secondary products. The yield variable was the reported output per feddan such as ardebs for wheat, maize and beans, kentars for cotton, and tons of rice.

Table 4.9 reports the statistical results for five crops, cotton, maize, wheat, fava beans and rice, and as can be seen, three sets of coefficients are reported for each crop.[3] The sample size, the standard coefficients a, b, and the R^2 are reported. The standard errors of each estimated parameter are given in

---

3. Quantitative yield data are not available for the berseem crops.

parentheses below the parameters. The 'a' constant indicates the man-days per feddan needed for harvest labor regardless of yield with the 'b' value indicating the additional man-days of labor required for each additional unit of yield.

Table 4.9. Results from regression analysis of relationships between harvest labor and yield, four crops.

Crop	Ave. Yield 1/	Harvest labor 1/	N	Ratio range (y/x) 2/	a	b	R^2
	(Man-days/FD)						
Cotton	5.69	37.66	742	1.38-36.8	33.992	1.181*	.011
					(17.383)	(.412)	
(Man-days/Kentar =		6.62	707	2.94-19.8	31.294*	1.722*	.028
					(15.262)	(.384)	
			637	2.94-13.8	21.416	2.990*	.100
					(13.079	(.350)	
Maize	14.10	10.47	299	.166-14.4	16.775*	-.263*	.014
					(8.371)	(.130)	
(Man-days/ardeb = 0.74)			285	.3-6.96	15.419	-.142	.003
					(8.410)	(.146)	
			241	.5-6.96	14.182	.0382	.0002
					(8.560)	(.162)	
Wheat	14.01	14.07	300	.171-3.9	7.228	.710*	.039
					(8.455)	(.200)	
(Man-days/ardeb=1.0)			291	.342-3.9	5.788	.807*	.057
					(7.817)	(.193)	
			280	.535-2.8	6.310	.777*	.067
					(6.909)	(.174)	
Fava beans	5.73	11.87	296	.068-250	15.220	-.056	.0004
					(8.315)	(.158)	
(Man-days/ardeb=2.07)			267	.66-30	13.203	.282	.010
					(7.759)	(.170)	
			253	.66-16	12.22	.410*	.018
					(7.80)	(.191)	
Rice	3.16	11.82	156	.16-11.1	10.192	.518	.003
					(6.354)	(.705)	
(Man-days/ton= 3.743)			143	.97-9.1	9.721	.827	.010
					(5.901)	(.675)	
			124	1.26-8.3	10.922*	.516	.007
					(4.652)	(.544)	

1/ Cost tables report weighted averages. Regression results weight each observation equally and are thus simple averages.
2/ Ratio range = range in the ratio of man-day equivalents of harvest labor versus per unit of output.

With this large sample size the coefficient is statistically significant at the 95 percent level if it is roughly twice the value of the standard error,(F = 1.96 at 95% probability level for large samples). All coefficients that are statistically significant at the 95 % level are also marked with an asterisk.

Table 4.9 presents three sets of regression estimates for each crop. The reason for several estimates is illustrated for cotton. Included in this table are the average yields and average man-day requirements for harvest labor as reported in the cost tables in Chapter II. With cotton, the average yield reported in Table 5.5 was 5.69 kentars and the average labor requirement for all harvest operations (pickings, transporting cotton and cutting and transporting stalks) was reported in Table 5.4 as 37.66 man-days. This means that the average harvest labor requirement was 6.62 man-days per kentar.

However, the individual data show an extremely wide range in this ratio (the y/x ratio). In the case of cotton, one farm reported as little as 1.38 man-days per kentar while another reported 36.8 man-days per kentar. Such extreme variations are hard to comprehend. It is hard to image why a farmer would spend 36.8 man-days to harvest only one kentar of cotton. This is almost 7 times the average. Nor is it physically possible to pick a kentar of cotton in only 1.4 man-days. This is about 1/4th of the average requirement.

These extreme values illustrate the problem of 'out-lyers'. Such extreme values are more likely errors in reporting than true estimates. In the case of fava beans, with one out-lyer,(250 man-days/ardeb of beans) the value of the labor used for harvest was worth 6.67 times the value of the beans being harvested. No farmer will harvest any crop if the cost of harvesting exceeds the value of the crop.

In the case of cotton, the first regression estimate based on all 742 observations (yield data were missing for 8 observations) gave a significant value for the 'b' coefficient and a nearly significant value for the 'a' coefficient but a very low R^2 . (The R^2 indicates the percent of the variation of the dependent variable "explained" or attributed to the independent variable.)

To 'improve the fit' some extreme outlyers were omitted. Such a process is mainly a judgmental operation. The most extreme estimates at both ends of the range were omitted. In the case of cotton the range in the y/x ratios was reduced from 1.38-35.8 man-days/kentar down to 2.94-19.8.

A similar process was followed with the other crops (Table 4.9), in the case of maize and fava beans the first estimates of the 'b' coefficients were negative or meaningless. The second round

of estimates gave the correct sign for favabeans but not for maize. In the case of maize, removal of more outlyers did little to improve the estimates.

The removal of outlyers can result in a shift in the average labor requirement unless outlyers are removed evenly at both ends of the range. The intention of these efforts was to arrive at reasonable estimates of the 'b' coefficients rather than the 'a' values. With cotton the regression results indicate a fairly flat regression line. Based on the 2nd and 3rd regression results, the estimated harvest labor requirements for cotton would be as follows:

Cotton Yield (Kentars)	Harvest labor required(Man-days) b = 1.722	b = 2.99
3	36.46	30.39
5	39.90	36.37
7	43.34	42.35
9	46.78	48.33

The data for wheat contained much fewer extreme outlyers. Most of the extreme estimates were low labor estimates. Three regression estimates were made but the results differed only slightly. All three 'b' values were similar and were also comparable to the average man-day requirement per ardeb of 1.0. In the case of wheat the regression line has much greater slope giving the following estimates with the first two regression equations:

Wheat Yield (Ardeb)	Harvest labor required(Man-days) b =.710	b = .807
10	14.33	13.86
14	17.17	17.09
18	20.01	20.31

The average yield reported by the sample farmers for beans was only 5.7 ardeb whereas normal yields are about 7 ardeb. The poor crop of beans in 1991-92 was no doubt partly responsible for the large number of extremely high labor requirements per ardeb discussed above and many of the very low reported yields were discarded as outlyers. The labor curve here determined is also quite flat, indicating little relationship between yield and labor requirement.

Bean Yield (Ardeb)	Harvest labor required(Man-days) b =.282	b = .410
5	14.61	14.27
7	15.17	15.09
9	15.74	15.91

As will be shown in Chapter V, a sizable fraction of the rice was reported as harvested with a mechanical rice combine (Table 5.25), and the amount of labor needed for the rice harvest was much less with the use of the combine than with hand harvest. Thus, the sample of rice farms was sub-divided on the basis of the method of harvest. A sample of 156 farms were available which harvested rice with out a combine. As shown in Table 4.9, the regression results for rice were not encouraging. None of the 'b' values obtained were near statistical significance. Removal of a large number of outlyers gave a statistically significant "a" value but as illustrated below, the labor curve would be very flat.

Rice yield (Ton)	Harvest labor required(Man-days) b = .516
2	11.96
3	12.47
4	12.99

The poor statistical results for rice can perhaps be explained by the fact that the rice yields reported contained little variation.

Since the harvest labor required for rice using a rice combine is so small compared to that with hand harvest, (average of LE 8/FD compared to LE 78/FD) the effect on harvest labor costs of yield variations would be economically insignificant. Also, since the results for hand harvest were not particularly encouraging, no attempts were made to regress labor against yield for rice harvested with combines.

Overall, the R^2 values are low. This indicates that many other variables are important and would have to be examined to achieve a 'full' explanation of the variation in harvest labor use. A thorough analysis of the relationship between labor use and yields should be based on data collected over several years to include varying price situations and weather conditions.

Size of operation versus harvest labor requirements:

The survey data available also included the area of the specific crop produced. Simple linear regression was used to test for relationship between the area of crop produced (size of operation) and the quantity of harvest labor per feddan as defined above. The results (Table 4.10) give highly significant 'b' values, with the expected sign, for all five crops. Here one would expect, and the results confirm, that the labor requirement per feddan declines as size of operation increases. This decrease can be expected as it reflects some mechanization on larger size farms and some crops versus almost total hand

operations on the smaller operations. Also, small farms tend to have a surplus of labor which promotes the use of labor with out comparable increases in productivity.

On the other hand one would not expect to see very significant results here on cotton since no mechanization is currently being used in cotton harvesting. The regression results for cotton are statistically significant but explain a very small percent of total variation, much less than on the other crops.

Table 4.10. Results from regression analyses of relationships between area of crop and harvest labor requirement, five crops.

Crop	N	a	b	R^2
Cotton	742	41.884*	-0.644*	.007
		(17.418)	(.280)	
Maize	299	15.621*	-1.763*	.107
		(7.966)	(.296)	
Wheat	300	18.700*	-0.790*	.063
		(8.350)	(.177)	
Fava beans	296	16.913*	-1.463*	.095
		(7.926)	(.264)	
Rice	156	12.874*	-0.338*	.048
		(6.208)	(.121)	

One might also note that the R^2s obtained here are greater than the results obtained when comparing harvest labor with yield. This seems to say that farm size is a more important variable determining the amount of harvest labor needed than is the yield? Perhaps further research on this topic is needed.

This second set of analyses do not prove that economies of size exist, but they indicate a likely possibility. If larger farmers are substituting capital in the form of mechanization we presume they are doing so to minimize production costs but perhaps their total costs per unit are not significantly lower than the small farmer. As farm size increases hired labor is substituted for family labor and thus the percent of costs that are cash costs increases, and even total unit costs may increase. Labor may be scarce and hard to find and mechanization is used not to replace labor but because labor is not available, and thus costs will not necessarily decline as a result of mechanization.

Cautions:

1. Although one might expect technology on Egyptian farms to be quite uniform between farms, the quantities of labor use reported varied widely between farms implying that costs are highly variable between farms, much more so than this author expected. A sample size of 300 is large for conditions of homogeneity, but perhaps things are not as homogeneous as expected and a larger sample is needed.

2. The most extreme outlyers seemed to be bunched in certain villages or districts. This may be due to the fact that yields in that village or district were low. However, this also might indicate that a specific enumerator was 'leading' his respondents or reporting incorrectly. Most likely, this bunching is the result of the lack of independence between observations in a village. It appears to be socially unacceptable in rural Egypt to give a private interview to a government enumerator. Thus, usually a dominant individual in the village will volunteer to be the first respondent, and his responses set the pattern for all successive interviews in that village. These results indicate that one should limit each survey to one observation per village. Thus, a sample of 300 should not be regarded as 300 independent observations, but perhaps should be evaluated on the basis of the number of villages sampled.

Fertilizer Costs

The surveys provided data on the quantities of fertilizer by type and on the costs of fertilizer. The fertilizer quantity data were summarized by nutrient. Thus, the average number of sacks reported as applied to a crop was multiplied by 50 KG and by the analysis of the fertilizer to get the KG of actual nutrients applied. For instance, one 50 KG sack of single super phosphate (SSP) which contains 15 percent phosphate, produces 7.5 KG of phosphate (P_2O_5). Thus, in Table 5.1 we show an average application to all cotton in 1991 of 79.48 KG/FD of nitrogen and 27.72 KG/FD of phosphate. To supply this amount of nitrogen would require 3.45 sacks (50 KG/sack) of urea at 46 % nitrogen or 4.75 sacks of ammonium nitrate(33.5 %).

The MALR recommended fertilizer use per feddan of cotton is 62 KG of nitrogen, 22.5 KG of phosphate (P_2O_5) and 2.4 KG of potassium (see Chap. I). Thus, on average, farmers in 1991 applied 28 percent more than the recommended amounts of nitrogen and 23 percent more than the recommended level of phosphates but only five percent of the recommended amount of potassium.

Miscellaneous costs

Cost estimates were obtained for manure, pesticides, animal costs, and machine operations at hired rates. Data on the physical units were not obtained on these four cost categories for various reasons. In the case of manure, a wide variety of units of measurement were reported which could not be converted into a standard measure. In the case of pesticides, physical units are meaningless because of the large variety of types of chemicals and concentration levels. For machinery and animal costs, hours could be measured but the rates paid differ with each type of animal or machine operation making this a complex data problem. Although some animal and machine inputs are owned and some hired, all costs under these two categories are priced at hired rates. Costs can be updated for all of these types of costs with a price indexing procedure.

CHAPTER V COST BUDGETS

Cotton

Tables 5.1-5.26 present the data obtained from the cost surveys. These tables present estimates for all crops stratified, as explained above, by the type or variety of cotton. A set of four tables are presented for each crop. The first table presents data on seed, manure, fertilizer and pesticides; the second covers machinery and animal costs; the third deals with labor quantities and costs; and the fourth table summarizing the costs and includes estimates of gross and net returns.[1]

Table 5.1. Seed, manure, fertilizer and pesticide costs, all varieties of cotton, 1991.

	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Sample size	225	357	168	750
Cotton per farm (FD)	1.73	1.95	1.59	1.81
Seed				
Kala/FD 1/	6.16	6.15	6.11	6.14
LE/Kala	1.09	1.20	1.50	1.24
LE/FD	6.71	7.37	9.17	7.59
Manure LE/FD	9.42	6.46	19.13	9.81
Nitrogen				
KG/FD	91.14	74.52	75.30	79.48
LE/FD	74.78	72.79	66.19	72.06
Phosphorus				
KG/FD	29.34	23.29	36.89	27.72
LE/FD	31.05	27.58	38.90	30.82
Potassium				
KG/FD	---	0.15	0.16	0.12
LE/FD	---	0.07	0.12	0.06
Pesticide LE/FD	---	2.33	---	1.20

1/ One ardeb = 12 Kala. (One ardeb of cotton seed = 120 KG)

---

1. In the cost estimates presented in this chapter the labor costs include were as reported in the surveys and were not adjusted for yields as was examined in Tables 4.9 and 4.10. Also, the return estimates are based on the yields reported in the cost surveys.

Table 5.2. Machinery and animal costs, all varieties of cotton, 1991.

	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Machinery costs:		(LE Per Feddan)		
Apply manure	10.24	17.80	9.12	13.91
Land preparation	40.43	36.58	37.97	37.96
Transportation	7.35	4.47	7.61	5.92
Irrigation	51.57	72.68	107.58	73.51
Apply pesticide	2.13	3.30	3.07	2.92
Other	1.60	4.76	0.75	3.06
Total	113.32	139.59	154.57	137.28
Animal costs:				
Transport manure	3.44	3.51	1.20	3.03
Tillage	1.05	---	0.11	0.34
Transport cotton	5.75	2.47	3.13	3.54
Other	0.31	0.17	0.28	0.22
Total	10.55	6.15	4.72	7.13

A summary of costs and returns for cotton appears in Table 5.4. The pest control costs included in Table 5.4 are the GOE charges for optional or additional sprayings for cotton pests requested by farmers and as reported in the Tranche V report on cotton.[2]

The cotton prices reported in Table 5.4 are average net prices received per seed kentar in 1991 also as reported by farmers in the Tranche V survey of cotton prices. These prices are net after the governments deductions for marketing charges and the basic subsidized cotton pest control program for which the farmer was charged only LE 20/FD.

---

2. See the Tranche V report cited in footnote 1.

Table 5.3. Labor costs, all varieties of cotton, 1991.

	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Man-day Equivalents/FD				
Apply manure	2.09	2.23	2.14	2.17
Tillage	4.26	3.64	3.80	3.85
Planting	2.90	3.73	3.48	3.44
Irrigation	3.92	4.38	7.16	4.85
Hoeing	9.26	10.01	18.51	11.64
Apply fertilizer	2.12	2.60	1.90	2.31
Pick worm eggs	0.56	1.61	0.35	3.50
Apply pesticide	9.15	1.16	0.72	0.89
Pick #1	19.33	23.26	26.81	22.90
Pick #2	12.91	8.87	4.24	9.03
Pick #3	0.19	0.28	0.02	0.20
Transport cotton	1.24	1.02	0.86	1.05
Cut & trans. stalks	4.13	4.05	5.90	4.48
Total	72.08	66.85	75.90	70.32
Ave. wage rate	4.68	4.30	4.66	4.62
Labor costs		(LE/FD)		
Apply manure	10.82	11.31	11.09	10.82
Tillage	21.10	18.22	17.43	19.04
Planting	14.08	17.29	16.12	16.15
Irrigation	18.57	20.61	32.35	22.47
Hoeing	46.88	51.48	86.13	56.17
Apply fertilizer	9.93	11.91	8.23	10.58
Pick worm eggs	45.00	6.44	1.38	16.54
Apply pesticide	2.88	5.36	3.08	4.09
Pick #1	84.76	100.05	129.37	101.62
Pick #2	56.25	36.95	20.84	39.61
Pick #3	0.82	1.06	0.10	0.80
Transport cotton	5.98	4.23	3.80	4.73
Cut & trans. stalks	20.33	14.84	28.15	22.52
Total	337.41	296.09	358.06	325.13

This points up one aspect of these cost estimates that needs emphasis. These estimates are **not** total resource costs but estimate only the costs faced by the producer. Not included in the cost calculations are the government costs for subsidies for pest control which averaged LE 208.60 per feddan of cotton in 1991. Nor are the various subsidies on fertilizer, cotton seed, or the interest subsidy of farm loans included as production costs. Adjustments to full economic costs will be made in Chapter VI.

Table 5.4. Summary of costs and receipts, all varieties of cotton, 1991.

	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Costs:		(LE/FD)		
Seed	6.71	7.37	9.17	7.59
Manure	9.42	6.46	19.13	9.81
Fertilizer	105.83	100.44	105.21	102.94
Pesticide	---	2.33	---	1.20
Machinery	113.32	139.59	166.10	137.28
Animal	10.55	6.15	4.72	7.13
Labor	337.41	296.09	358.06	325.13
Pest control	25.52	50.53	37.00	40.67
Total costs	608.75	610.74	699.39	631.76
Receipts:				
Cotton				
Kentar/FD	5.77	5.76	5.45	5.69
LE/Kentar	362.42	297.88	314.69	320.18
LE/FD	2091.17	1715.01	1715.94	1823.36
Stalks				
Heml/FD	1.13	2.85	3.10	2.41
LE/Heml	5.23	9.55	4.43	7.53
LE/FD	5.88	27.19	13.72	18.14
Total gross receipts				
LE/FD	2097.05	1742.20	1729.66	1841.50
Net receipts to land, capital and management				
LE/FD	1488.30	1131.46	1030.27	1209.74

Maize

In the cost summary tables the net return estimates are labeled as "Net Receipts to land, capital and management". No costs have been included in these estimates for land or capital. Thus, the net return estimate is not a net profit but is an amount that must be used to pay the land and capital used and also provide some return to the manager for his risk taking and management.

Table 5.5. Seed, manure, fertilizer and pesticide costs, maize, all governorates, 1991.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Sample size	90	136	74	300
Maize per farm (FD)	1.46	1.14	1.98	1.44
Seed				
KG/FD	18.94	18.13	15.01	17.32
LE/KG	2.30	2.32	2.89	2.48
LE/FD	43.64	42.14	43.37	43.02
Manure LE/FD	25.88	13.44	11.18	16.46
Nitrogen				
KG/FD	91.32	100.14	99.94	97.39
LE/FD	70.04	96.96	91.94	87.07
Phosphorus				
KG/FD	20.37	14.45	18.73	17.70
LE/FD	23.29	16.37	21.89	20.34
Potassium				
KG/FD	---	---	0.49	0.17
LE/FD	---	---	0.25	0.08
Herbicide LE/FD	0.88	1.18	0.19	0.76
Insecticide LE/FD	16.85	12.20	9.79	12.80

Table 5.6. Machinery and animal costs, maize, all governorates, 1991.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Machinery costs:		LE/FD		
Land preparation	34.54	35.61	33.51	34.58
Irrigation	47.74	54.90	83.49	62.39
Apply insecticide	1.95	4.99	3.18	3.45
Separate grain	7.77	1.12	9.26	5.90
Transport	7.26	6.28	9.49	7.66
Other	1.09	3.75	9.33	4.83
Total	100.35	106.65	126.49	118.81
Animal costs:		LE/FD		
Transport	4.33	8.51	6.81	6.27
Other	1.30	1.11	0.19	0.86
Total	5.60	8.51	7.01	7.13

Table 5.7. Labor costs, maize, all governorates, 1991.

	Areas stratified by cotton production: ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Man-day equivalent/FD				
Apply manure	1.41	2.28	1.32	1.69
Land preparation	2.19	2.43	2.23	2.29
Planting	2.62	3.37	2.63	2.89
Irrigation	3.43	4.22	4.32	4.01
Weeding	7.03	7.67	9.91	8.23
Replanting	0.44	0.48	0.38	0.44
Apply fertilizer	2.07	2.97	2.11	2.40
Apply herbicide	0.19	0.38	0.31	0.30
Apply insecticide	0.85	0.91	0.73	0.83
Harvest	7.93	9.11	7.88	8.34
Transport	2.46	2.55	1.38	2.13
Total	30.61	36.38	33.22	33.56
Aver. wage rate	4.86	4.67	4.68	4.73
Labor costs:			(LE/FD)	
Apply Manure	6.78	10.20	6.79	8.00
Land preparation	10.94	11.63	10.39	11.00
Planting	13.37	15.07	12.41	13.65
Irrigation	16.08	19.54	19.77	18.56
Weeding	33.85	37.41	46.41	39.37
Replanting	2.13	1.96	1.82	1.96
Apply fertilizer	9.21	12.65	9.64	10.58
Apply herbicide	0.92	1.61	1.47	1.35
Apply insecticide	4.23	4.14	3.66	4.01
Harvest	39.70	43.61	36.91	40.15
Transport	11.66	12.00	6.21	9.93
Total	148.86	169.82	155.47	158.59

The estimates here presented for maize, as for all other crops, reflect 1991 season yields and prices. Yields and product prices vary from year to year, particularly product prices. The returns in Table 5.8 are based on maize prices of about LE 60 per ardeb. Maize prices in 1991 were depressed due to a large crop. A price of LE 70 per ardeb is more nearly a planning price. With a maize price of LE 70/ardeb, average net returns to maize would be about LE 550/FD.

Table 5.8. Summary of costs and receipts, maize, all governorates, 1991.

	Areas stratified by cotton production: ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Costs:		LE/FD		
Seed	43.64	42.14	43.37	43.02
Manure	25.88	13.44	11.18	16.46
Fertilizer	93.33	113.33	114.08	107.49
Herbicide	0.88	1.18	0.19	0.76
Insecticide	16.85	12.20	9.79	12.80
Machinery costs	100.35	106.65	148.27	118.81
Animal costs	5.60	8.51	7.01	7.13
Labor	148.86	169.82	155.47	158.59
Total costs:	435.39	467.27	489.36	465.06
Receipts:				
Maize				
Ardeb/FD	14.52	14.18	13.63	14.10
LE/Ardeb	54.31	61.61	65.77	60.68
LE/FD	788.82	873.53	896.62	855.58
Stalks:				
Heml/FD	4.29	2.30	4.57	3.67
LE/Heml	8.58	3.84	3.51	5.17
LE/FD	28.62	15.01	15.59	19.35
Total receipts				
LE/FD	817.44	888.54	912.22	874.93
Net receipts to land, capital and management				
LE/FD	382.05	421.27	422.86	409.87

Wheat

Costs and returns data for wheat are included in Tables 5.9 to 5.12. The wheat yields reported in Table 5.12 indicate an average yield on the sample farms of 14 ardeb/FD. Wheat yields have exhibited a strong upward trend over the past 10 years with the national average at 14.56 ardeb/FD in 1990 (see Table 3.5). Further yield increases can be expected in the future.

These yield increases have resulted from the adoption of new varieties but also from the use of a package of additional inputs, especially fertilizer, and as a result of the yield increases, more harvest labor is needed. Other input costs which will also likely increase with yields includes fertilizer and seed. Fertilizer use must increase with yield increases to provide the needed plant nutrients. Seed costs will likely increase as farmers shift from the use of baladi seed to improved seeds. These yield trends should be considered when comparing profits of cropping rotations.

Note that wheat straw is a fairly valuable by-product. It provided, on average, 14 percent of the total value of the receipts of the wheat enterprise in 1991-92. In most other Egyptian crops the plant residues have very little value.

Table 5.9. Seed, manure, fertilizer and pesticide costs, wheat, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS	LS varieties		ALL
	varieties	Giza 75	Other	varieties
Sample size	85	128	87	300
Wheat per farm (FD)	1.37	1.62	1.56	1.53
Seed				
Kala/FD	5.93	5.81	5.78	5.83
LE/Kala	9.16	9.55	10.24	9.65
LE/FD	54.26	55.52	59.19	56.29
Manure LE/FD	18.42	23.21	14.21	19.34
Nitrogen				
KG/FD	72.48	62.66	81.25	70.65
LE/FD	76.90	66.73	88.54	75.76
Phosphorus				
KG/FD	21.99	20.05	18.11	19.97
LE/FD	28.28	26.68	23.79	26.23
Potassium				
KG/FD	1.44	0.12	---	0.42
LE/FD	1.08	0.09	---	0.32
Herbicide LE/FD	5.19	11.16	8.11	8.74
Insecticide LE/FD	6.21	2.15	7.82	4.86

Table 5.10. Machinery and animal costs, wheat, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Machinery costs:		LE/FD		
Land preparation	29.72	30.57	32.31	30.87
Irrigation	31.03	52.50	76.60	54.19
Apply pesticide	3.48	2.33	4.84	3.37
Separate grain	83.03	61.44	62.17	67.13
Transport	7.16	4.27	10.00	6.70
Other	0.13	3.74	3.03	2.61
Total	154.55	154.84	188.95	164.86
Animal costs:				
Apply manure	0.48	0.01	0.22	0.19
Transport	5.31	4.97	5.12	5.10
Other	0.03	3.23	1.57	1.93
Total	5.70	8.21	6.69	7.12

Table 5.11. Labor costs, wheat, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Man-days equivalent/FD				
Apply manure	0.88	0.55	0.64	0.66
Land preparation	1.47	1.59	2.49	1.83
Planting	1.33	1.11	0.93	1.11
Irrigation	1.79	2.63	3.32	2.62
Weeding	1.33	1.80	0.80	1.38
Apply fertilizer	1.32	1.24	1.09	1.22
Apply pesticide	0.66	0.58	1.10	0.76
Harvesting	11.16	11.20	14.35	12.12
Transport	2.04	1.94	1.88	1.95
Total	21.99	22.64	26.60	23.65
Aver. wage rate	4.86	5.44	5.01	5.16
Labor costs:				
Apply manure	4.02	2.89	3.30	3.30
Land preparation	6.99	7.96	12.18	8.96
Planting	6.18	5.73	4.31	5.43
Irrigation	8.13	12.92	15.51	12.47
Weeding	6.09	8.64	3.65	6.52
Apply fertilizer	6.12	5.90	4.87	5.65
Apply pesticide	3.16	3.08	5.18	3.72
Harvesting	56.60	65.86	74.98	66.21
Transport	9.54	10.10	9.28	9.72
Total	106.84	123.08	133.25	121.97

Table 5.12. Summary of costs and receipts, wheat, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS	LS varieties		All
	varieties	Giza 75	Other	varieties
Costs:				
Seed	54.26	55.52	59.19	56.29
Manure	18.42	23.21	14.21	19.34
Fertilizer	106.26	93.50	112.33	102.31
Herbicide	5.19	11.16	8.11	8.74
Insecticide	6.21	2.15	7.82	4.86
Machinery	154.55	154.84	188.95	164.86
Animal	5.70	8.21	6.69	7.12
Labor	106.84	123.08	133.25	121.97
Total costs	457.43	471.68	530.55	485.49
Receipts:				
Wheat				
Ardeb/FD	14.00	13.97	14.06	14.01
LE/Ardeb	74.15	75.07	80.99	76.59
LE/FD	1038.26	1048.68	1138.94	1072.74
Straw				
Heml/FD	7.40	8.77	9.90	8.76
LE/Heml	21.98	15.29	23.00	19.30
LE/FD	162.74	134.05	227.75	169.04
Total receipts:	1201.00	1182.73	1366.69	1241.78
Net receipts to land, capital and management				
LE/FD	743.57	711.05	913.13	756.29

Fava Beans

Cost data for fava beans are presented in Tables 5.13 to 5.16. The 1991-92 winter season was a poor season for fava beans, particularly in Upper Egypt. Yields reported by the sample farmers (Table 5.16) averaged only 5.7 ardeb whereas normal yields are 7-8 ardeb. Cost data obtained from this survey are probably somewhat normal except for harvest related costs which were probably somewhat lower than normal. When using these cost data for planning purposes, yields over several years should be used in place of the yields reported here.

Table 5.13. Seed, manure, fertilizer and pesticide costs, fava beans, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Sample size	84	87	128	299
Beans per farm (FD)	1.45	1.71	1.13	1.39
Seed				
Kala/FD	5.01	6.54	5.16	5.61
LE/Kala	19.99	30.09	26.65	26.35
LE/FD	100.21	196.69	137.60	147.84
Manure LE/FD	2.10	14.17	10.63	9.37
Nitrogen				
KG/FD	20.29	37.36	26.11	28.33
LE/FD	23.91	42.21	29.17	32.18
Phosphorus				
KG/FD	28.26	28.95	41.13	33.12
LE/FD	36.37	38.45	53.98	43.41
Potassium				
KG/FD	1.98	0.17	0.16	0.69
LE/FD	1.50	0.17	0.13	0.55
Herbicide LE/FD	28.75	20.53	6.19	17.79
Insecticide LE/FD	31.79	30.65	30.65	30.99

Table 5.14. Machinery and animal costs, fava beans, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Machinery costs:		(LE/FD)		
Land preparation	41.93	30.35	30.16	33.67
Irrigation	33.15	36.61	49.49	40.21
Apply herbicide	0.00	2.50	0.96	1.21
Apply insecticide	6.93	6.79	7.42	7.06
Separate grain	50.46	51.76	39.32	46.92
Transport	4.42	5.71	10.01	6.87
Other	1.48	1.53	2.07	1.71
Total	138.37	135.24	139.43	137.65
Animal costs:				
Transport grain	9.68	0.35	0.62	3.18
Transport straw	2.13	4.84	5.56	4.31
Other	5.36	1.64	1.26	2.59
Total	17.17	6.83	7.44	10.08

Table 5.15. Labor costs, fava beans, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Man-day equivalent/FD				
Apply manure	0.10	1.09	2.01	1.71
Land preparation	1.23	1.80	3.77	3.42
Planting	2.91	3.48	2.95	2.36
Irrigation	0.94	2.94	3.86	3.87
Hoeing & wedding	4.56	3.30	0.93	0.86
Replanting	0.50	0.87	1.04	0.71
Apply fertilizer	1.12	1.70	1.27	1.37
Apply herbicide	0.12	0.58	0.22	0.32
Apply insecticide	1.61	1.26	1.32	1.38
Harvesting	6.55	7.07	6.89	6.85
Separate & clean	3.36	4.23	2.73	3.43
Transport	1.82	1.70	1.30	1.59
Total	24.81	30.04	28.29	27.88
Ave. wage rate	4.80	5.23	4.74	4.94
Labor costs		(LE/FD)		
Apply manure	0.52	4.31	5.08	3.48
Land preparation	5.81	9.41	9.50	8.39
Planting	13.93	17.30	18.30	16.67
Irrigation	4.26	14.14	13.43	10.99
Replanting	2.03	5.40	3.56	3.75
Hoeing & weeding	21.35	15.56	18.40	18.27
Apply fertilizer	5.19	8.12	5.62	6.37
Apply herbicide	0.61	3.19	1.08	1.67
Apply insecticide	8.58	6.52	5.88	6.89
Harvesting	32.13	41.82	33.80	36.11
Separate & clean	15.99	22.82	13.27	17.40
Transport	8.69	8.40	6.10	7.66
Total	119.10	156.99	134.01	137.65

Berseem

In the case of both short season and long season berseem, a physical measure of output is difficult to obtain. Actually in practice, berseem is commonly measured and sold per cutting per kerat or per feddan and not by volume or weight. Thus for long season berseem the average number of cuttings reported was 3.87 with an average price of LE 252 per cutting per feddan (Table 5.20). With short berseem the average number of cuts reported was 1.92 with an average price of LE 224 (Table 5.21).

Table 5.16. Summary of costs and receipts, fava beans, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Costs:		(LE/FD)		
Seed	100.21	137.60	196.69	147.84
Manure	2.10	14.17	10.63	9.37
Fertilizer	61.78	80.83	83.28	76.14
Herbicide	28.75	20.53	6.19	17.79
Insecticide	31.79	30.65	30.65	30.99
Machinery	138.37	135.24	139.43	137.66
Animal	17.17	6.83	7.44	10.08
Labor	119.10	156.99	134.01	137.65
Total cost	499.27	582.86	608.33	567.51
Receipts:				
Beans				
Ardeb/FD	7.08	6.66	3.72	5.73
LE/Ardeb	181.88	179.50	200.91	185.35
LE/FD	1286.88	1195.53	747.59	1061.63
Stalks				
Heml/FD	4.23	3.22	5.56	4.35
LE/Heml	15.16	10.88	13.55	13.32
LE/FD	64.16	35.03	75.26	58.00
Total receipts				
LE/FD	1351.05	1230.57	822.85	1119.63
Net receipts to land, capital and management				
LE/FD	863.12	647.71	234.98	555.44

The survey data indicated a large variation in the prices of berseem between governorates and between seasons. These price data were not analyzed but these yield and price data were obtained for all farms producing berseem in the entire sample of 2250 farms. Thus, geographic and season price differentials could easily be estimated. It is likely that the price of berseem is highest in early fall and in late spring when the supply is low. The higher price reported for long berseem versus short berseem may reflect either seasonal or geographic differences.

Both berseem crops are occasionally sold while still standing in the field. When this occurs the cost of cutting is borne by the buyer and the price paid to the farmer is lower than where the berseem has been cut. The data reported here includes some of these situations, particularly in the ELS cotton areas, and as a result, the average prices here reported for berseem are below that of cut berseem and the labor costs reported do not represent total labor costs for berseem production as was discussed earlier.

Table 5.17. Seed, manure, and fertilizer costs, long berseem, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Sample size	85	128	87	300
FD per farm	1.76	1.30	1.10	1.37
Seed:				
Kala/FD	2.02	2.05	2.43	2.12
LE/Kala	28.56	31.03	33.83	30.93
LE/FD	57.57	63.52	82.14	65.69
Manure LE/FD	1.67	3.15	17.04	5.85
Nitrogen				
KG/FD	17.42	16.78	21.27	18.05
LE/FD	17.68	19.09	22.80	19.44
Phosphorus				
KG/FD	22.81	27.13	30.88	26.44
LE/FD	29.76	35.21	40.80	34.53
Potassium				
KG/FD	0.32	0.29	---	0.23
LE/FD	0.24	0.24	---	0.18
Herbicide LE/FD	---	0.21	1.03	0.33
Insecticide LE/FD	---	2.32	2.51	1.52

Table 5.18. Machinery and animal costs, long berseem, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Machinery costs:		(LE/FD)		
Land preparation	18.15	16.76	24.17	18.99
Transport	9.89	4.27	2.19	5.83
Irrigation	22.41	45.62	84.17	46.17
Other	8.29	1.05	3.18	4.17
Total	58.74	67.71	113.71	75.16
Animal costs:				
Land preparation	0.20	0.94	---	0.45
Transport	7.41	23.24	40.69	21.56
Irrigation	5.22	0.73	---	2.19
Other	1.39	0.11	0.37	0.63
Total	14.22	25.04	41.06	24.84

Table 5.19. Labor costs, long berseem, all governorates, 1991-92.

	Areas stratified by cotton production: ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Man-day equivalents	33.48	34.71	38.67	35.19
Ave. wage rate	4.23	4.95	4.44	4.57
Labor costs:		(LE/FD)		
Apply fertilizer	5.23	6.94	5.98	6.10
Land preparation	3.27	6.28	10.66	6.21
Planting	4.61	5.45	4.22	4.86
Cutting	89.42	97.58	108.76	97.22
Transport	16.38	35.48	16.42	24.11
Irrigation	16.58	19.88	21.36	19.02
Other	6.14	0.29	4.28	3.34
Total	141.62	171.90	171.68	160.86

Table 5.20. Summary of costs and receipts, long berseem, all governorates, 1991-92.

	Areas stratified by cotton production: ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Costs:		(LE/FD)		
Seed	57.57	63.52	82.14	65.69
Manure	1.67	3.15	17.04	5.85
Fertilizer	47.68	54.54	63.60	54.15
Herbicide	---	0.21	1.03	0.33
Insecticide	---	2.32	2.51	1.52
Machinery	58.74	67.71	113.71	75.16
Animal	14.22	25.04	41.06	24.84
Labor	141.62	171.90	171.68	160.86
Total costs:	321.50	388.39	492.77	388.40
Receipts:				
Berseem				
Ave. no. cuts	3.61	4.08	3.71	3.82
LE/cut	226.44	272.36	253.38	252.33
LE/FD	817.88	1111.66	940.10	965.08
Berseem seed				
Ardeb/FD	0.44	0.15	0.10	0.24
LE/Ardeb	214.46	257.48	301.11	233.06
LE/FD	94.32	37.66	29.03	56.22
Total	912.21	1149.32	969.12	1021.30
Net receipts to land, capital and management				
LE/FD	590.71	760.93	476.35	632.90

Table 5.21. Summary of costs and receipts, short berseem, all governorates, 1991-92.

	Areas stratified by cotton production:			
	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
Sample size	85	128	87	300
S. Berseem/farm(FD)	2.05	0.98	1.14	1.33
Seed				
Kala/FD	1.97	2.02	2.40	2.09
LE/Kala	29.49	34.99	35.05	32.75
LE/FD	58.06	70.79	84.25	68.56
Manure LE/FD	1.80	0.12	8.64	2.97
Nitrogen				
KG/FD	4.34	7.89	15.51	8.23
LE/FD	4.73	8.61	16.95	8.99
Phosphorus				
KG/FD	17.77	19.56	26.43	20.48
LE/FD	23.09	26.31	34.64	26.97
Potassium				
KG/FD	---	0.19	0.73	0.24
LE/FD	---	0.14	0.61	0.20
Herbicide LE/FD	0.11	---	0.09	0.07
Insecticide LE/FD	0.34	1.64	3.74	1.59
Machinery costs:			(LE/FD)	
Land preparation	7.46	13.23	26.81	14.07
Transport	1.68	3.19	1.56	2.13
Irrigation	6.85	26.86	42.74	22.05
Total	16.00	43.38	71.11	38.25
Labor costs:				
Land preparation	3.75	8.34	9.82	6.70
Planting	4.69	5.03	5.53	5.01
Apply fertilizer	3.92	5.78	5.15	4.81
Cutting	37.83	41.81	62.05	45.09
Transport	4.26	15.29	12.96	9.88
Irrigation	0.45	9.42	9.44	5.50
Other	0.83	---	0.52	0.49
Total	55.74	85.67	105.47	77.49
Animal costs				
Transport	7.15	8.28	26.10	12.21
Other	0.15	0.36	---	0.18
Total	7.30	8.64	26.10	12.39
Total costs:	167.17	245.13	351.00	237.36
Receipts:				
No. cuts	2.02	1.69	2.05	1.92
LE/cut	190.04	231.41	278.26	224.73
LE/FD	383.27	391.76	569.55	432.19
Net receipts to land, capital and management				
LE/FD	216.10	146.63	218.55	194.83

Rice

Data on costs of production on rice were not collected in the set of surveys discussed above because a survey of 600 rice producers had previously been conducted during late 1991 on 1991 production practices.[3] Rice is produced only in some governorates with all major rice producing governorates being located in Lower Egypt. Thus, rice is an alternative to cotton only in those areas that produce Giza 75 and the ELS varieties.

This sample of 600 rice farmers was divided between governorates and farm size as shown in Table 5.22. This sample was distributed by size of farm in proportion to the area of production of these size farms.

Table 5.22. Sample of rice producers, 1991.

	Area of rice per farm			
Governorate	Less than 5 FD	5-15 FD	Over 15 FD	Total
Behira	72	36	12	120
Sharquia	36	18	6	60
Damietta	36	18	6	60
Gharbiya	75	33	12	120
Kafr el Sheikh	72	36	12	120
Daqahliya	72	36	12	120
Total	363	177	60	600

The sample was also stratified into three groups on the basis of rice seeding technology of production. Of the total sample, 523 farms used the method of transplanting of the seedlings, 48 farms broadcast seed directly into the fields and 29 farms planted the rice seed into the fields but into small pits made for the seeds.

Rice production technology does not differ geographically within the major rice producing governorates. The survey results were summarized by size of farm and by plant technology but results will be presented here only for the total of all sample farms.

With rice, the major type of nitrogen fertilizer used by the sample farms was ammonium sulfate (AS)(Table 5.23). As an average of all sample farms, 3.41 sacks of AS and 0.45 sacks of urea were used to produce 45.5 KG of nitrogen per feddan of rice. All phosphate was reported to be provided by single super

---

3. The survey of rice producers was conducted by the General Sampling Directorate of the Undersecretariat for Economics and Statistics, MALR, GOE.

phosphate (15%) SSP which required 1.95 sacks per feddan (14.66 KG of P2O5/FD). No potassium was reported to be used by the sample farms on rice. A small percent of farms reported use of zinc sulfate for an average of LE. 0.37 per feddan. This survey did not distinguish between herbicides and insecticides but reported an average expenditure of LE 28.80 per feddan for all types of pesticide.

Table 5.23. Input costs, rice, all governorates, 1991.

Item	Per Feddan
Seed	
Kala/FD	5.90
LE/Kala	6.60
LE/FD	38.91
Manure LE/FD	8.05
Nitrogen	
KG/FD	45.50
LE/FD	42.42
Phosphorus	
KG/FD	14.66
LE/FD	15.19
Zinc Sulfate LE/FD	0.37
All pesticides LE/FD	28.80

The survey of rice farmers included a category of costs called "General Expenses" which included items such as costs of cleaning drains, costs of field drainage, repair costs for irrigation pumps, security costs and other general costs. These cost items were not itemized in the other cost surveys. These items totaled LE 23.10 per feddan on the rice farms.

The survey of rice producers also gathered data on land taxes and land rent which were not included in the other surveys. In the rice survey the land taxes were reported to average LE 19.13 per feddan and land rent averaged LE 110 per feddan.[4]

The rice survey also obtained data on labor use by men, women and children for each operation and a wage rate was obtained for each operation and each gender of worker. This survey data did not distinguish between hired and family workers as was done in the surveys of the other crops.

---

4. Fixed costs of drainage, land taxes and land rents were not included in the MALR surveys since these costs remain fixed per feddan in a rotation regardless of the crop produced. If the study is designed to compare net returns of crops, these costs can be ignored. If the purpose is to estimate total costs or net incomes to farmers, such fixed costs must be included.

To summarize the labor cost estimates, total labor costs were determined for each operation and then divided by the average wage rate for men to obtain an estimate of man-day equivalents. This is the same procedure as was used in the other crop cost surveys.

Two different harvest technologies were reported in the survey. A large percent of the farms, including primarily the larger farms but with some differences by Governorate, reported harvesting rice with a combine while generally smaller farms harvested rice by hand and used a stationary threshing machine to thresh the rice. The farms were separated on the basis of the type of harvest reported and the costs were summarized separately to give a comparison of costs by harvest method in Table 5.24. Average harvest costs are reported in Table 5.26.

Table 5.24. Harvest costs for rice with and without combines, 1991.

Cost item	Harvesting with a rice combine:	Harvesting without a rice combine:
Average FD. per farm	8.53	3.08
Yield (Tons/FD)	3.14	3.09
Harvest Labor cost:		
Man-day equiv. (days/FD)	1.54	15.94
Wage rate (LE/Man-day)	5.04	4.90
Labor cost(LE/FD)	7.76	78.11
Machine cost (LE/FD)	146.26	51.27
Total harvest cost	154.02	129.38

Although the survey sample was stratified to give separate costs estimates for farms using transplants and farms seeding directly into fields, the estimates presented here are a weighted average of the entire sample of farms. As reported above, 87 percent of the sample farmers still seed into small beds and then transplant the small plants into the fields. The newer technology of seeding directly into fields is not widely used currently but may become more commonly used in the future. The field seeding operations here reported thus represent the average costs over all sample rice farms. These estimates of labor costs (Table 5.26) are reported per average feddan of field rice including the costs of the transplant beds.

Land leveling can be performed on dry fields or after water is applied. All land leveling in transplant beds was reported as being performed after water is applied.

Table 5.25. Labor costs, rice, all governorates, 1991.

Item	Man-days per feddan	Wage rate (LE/man-day)	Labor cost (LE/FD)
Transplant bed operations:			
Transport manure	.24	5.01	1.20
Apply manure	.14	4.84	.67
Hoeing	.02	3.71	.07
Leveling land	.17	7.07	1.20
Transport seeds	.12	4.72	.54
Prepare seeds	.10	4.59	.44
Seeding	.13	3.79	.48
Apply fertilizer	.10	4.71	.46
Irrigation	.15	5.03	.73
Control weeds	.48	4.36	2.09
Move plants	2.02	6.07	12.27
Total	3.65	5.52	20.16
Permanent fields:			
Transport manure	.24	5.15	1.22
Apply manure	.05	4.84	.26
Hoeing	.06	3.74	.21
Level land(dry)	.16	5.79	.94
Level land(wet)	.54	8.29	4.48
Transport plants	1.84	5.59	10.27
Transplanting plants	5.28	4.57	24.14
(Field seeding)			
Transport seeds	.02	5.25	.09
Seed preparation	.09	4.42	.38
Seeding	.07	4.78	.34
Apply fertilizer			
1st application	.59	4.82	2.82
2nd application	.41	4.85	2.00
3rd application	.08	4.83	.37
Weed control	1.17	4.50	5.28
Irrigation	2.06	4.82	9.91
Pull grass	2.01	3.95	7.93
Pest control	.21	4.28	.89
Disease control	.05	4.67	.23
Total(pre-harvest)	14.93	4.81	71.76
Harvest	5.51	5.24	28.87
Transport	1.08	4.90	5.29
Total	25.17	5.01	126.08

Comparison with other data sources

One may note differences between the estimated labor requirements for cotton and other crops presented in this Chapter and the labor estimates obtained from the U/AES of the Ministry of Agriculture which were discussed in Chapter III. Other

differences between these costs estimates and official MALR cost estimates, and a comparison with other recent survey data is forthcoming in a release from the Agricultural Production and Credit Project[5].

Table 5.26. Summary of costs and receipts, rice, all governorates, 1991.

Item			LE/FD
Costs:			
Inputs:			
Seed			38.91
Manure			8.05
Fertilizer			57.98
Pesticides			28.80
General expenses			23.10
Sub-total			156.84
Operations:	Labor	Mach. & animal	
Transplant beds:	20.16	47.15	67.31
Fields:			
Trans. & apply manure	1.48	3.18	4.66
Hoeing and leveling	5.63	38.57	44.20
Moving plants or seeding	35.22	12.02	47.24
Irrigation	9.91	106.29 1/	116.20
Fertilizing	5.19	2.78	7.97
Weed, grass & pest control	14.33	5.03	19.36
Harvest	28.87	117.72	146.59
Transport	5.29	15.85	21.14
Sub-total	105.92	301.44	407.36
Land tax			19.13
Total costs			645.00
Receipts:	Rice	Straw	
Tons/FD	3.055		
LE/Ton	402.03		
LE/FD	1228.20	41.34	1269.54
Net receipts to land, capital and management:			624.54

1/ A large number of farmers contract with neighboring farmers to irrigate their rice fields. Costs of this labor furnished by these contractors is here included as part of the hired machine and animal costs but not as a labor cost.

---

5. See Chapter 5 of APCP Deliverable WP-VI/1.3.1.B, April, 1994

CHAPTER VI. COMPARATIVE RETURNS TO CROPPING ROTATIONS

The cost estimates reported in Chapter V can be used to directly compare the costs and returns of individual crops but these cost data can also be combined to give estimates of returns for various cropping rotations. In Egypt, except for sugar cane and orchard crops, two crops are usually produced on the same land during a year, a summer crop and a winter crop.

If possible, a farmer would choose to grow the combination of two most profitable crops, or thus the most profitable rotation. However, all combinations of crops are not possible. Cotton requires a relatively long growing season (8 months) and must be planted prior to the normal harvesting dates for wheat. The optimal planting period for cotton in Upper Egypt, as determined by the MALR, is the first two weeks of March and in the Delta it is the last two weeks in March. On the other hand, wheat is not harvested in Egypt until May or June. So combining cotton and wheat in a rotation is not biologically possible, at least with the varieties currently grown in Egypt.

Short season berseem is produced in Egypt primarily because of the need for a short season winter crop in combination with cotton. Additional cuttings of berseem are foregone to allow the planting of cotton in a timely manner. Thus, cotton production currently limits the choice of major winter crops to short season berseem and, in some areas, fava beans or vegetables.

But all land in any area would not likely be planted to the most profitable crop rotation. Crop disease prevention requirements limit cotton to specified rotations. The same applies to other crops.

In addition, these cost estimates report the average situation. Due to a variety of factors, the most profitable rotation will vary between farmers in the same area. Some farmers have greater skills with certain crops so their yields would be better than their neighbors. Differences in soils exist which cause one crop to perform better in some areas than in others. Also, where a small difference in profit between two rotations exists, farmers may simply grow those crops they enjoy growing rather than the most profitable ones.

Risk is a very important factor affecting cropping plans that has not thus far been mentioned. Under irrigation, crop yields are less variable than under rain-fed conditions but disease, insect infestation, and other weather variables do still cause variation in yields. And as the agricultural economy moves toward privatization, price variability, both for inputs and products,

will increase along with yield variability. Diversification has always been recognized as a useful measure to counteract the impacts of variability and thus most farmers would prefer to grow at least two crops in a season to spread their risk.

Another important factor causing crop diversification is the timing of labor operations. The best or optimal times to perform operations for one crop are generally different from that of other crops. Thus, with a fixed supply of labor a farmer can spread his work load by crop diversification and thus farm more land than if he were to plant all of his land to the same crop.

INPUT SUBSIDIES

In the past, the GOE has controlled the prices of many agricultural commodities including wheat, beans, cotton, rice and sugarcane. Under the policy reform program, wheat and beans were liberalized in 1987. Mandatory deliver of rice quotas was eliminated in 1991.

To compensate farmers for low crop prices, the GOE has subsidized the prices of several crop inputs including fertilizer, seeds, interest on crop production loans, and pesticides, particularly for cotton pest control. The purpose of this study is to examine the competitiveness of various crops in a free market, non-subsidized situation. Thus, any reduced costs due to subsidies as reported in the survey data in Chapter II must first be accounted for and removed to reflect full economic costs

Seeds

Practically all subsidies on seeds were removed by the time of these crop surveys. The Tranche V report on the APCP policy reform program reports that during FY 1991-92 wheat seed was the only seed subsidized that year and the entire subsidy was used to support wheat production in the rain-fed area along the Mediterranean north coast. These areas were not included in the surveys reported in Chapter II and hence were not included in these results.

On the other hand, the MALR was distributing most of the seed used for wheat, rice and fava beans during the 1991-92 seasons that was not home-grown (Table 6.1). Although no budget subsidy was given to PBDAC or to the co-operatives for this distribution, it is most probable that the prices of seed for these crops would have been higher if they had been distributed by the private sector. The MALR has purposely kept seed prices at low levels to encourage farmers to use the improved MALR seeds rather then home-grown seed to improve yields. These three crops are self-pollinated crops for which the farmer can retain seed from a previous crop.

The MALR seed activities may not have been subsidized through direct budget subsidies but cost accounting of the seed activities have not included all equipment replacement costs or all costs of MALR employees. During the 1993-94 calendar years some privatization of the production and distribution of these self-pollinated seeds has proceeded.[1]

Table 6.1. Sources of seeds, 1992-93 crop season.

Crop	PBDAC or co-operatives	Private merchants	Own seed or neighbors
		(Percent)	
Cotton	99	1	0
Maize	48	8	44
Rice	59	1	40
Wheat	63	8	29
Fava beans	31	28	42
Berseem	8	39	53

Source: Field surveys conducted by MALR for the Tranche VI report. Maize seed obtained from neighbors or kept from previous crops was not hybrid seed.

It is expected that when the distribution of these seeds is completely privatized the price will increase by 50 percent, however, as shown in Table 6.1, not all of these seeds are purchased. Thus, for example, the overall average price of rice seed would be expected to increase by 30 percent under privatization (50 percent increase X 59 percent of the seed), wheat seed would increase by 32 percent and fava bean seed would increase by 16 percent.

Farmers obtain berseem seed primarily from their own previous crops, from neighbors, or through the private sector (See Table 6.1). Improved (hybrid) maize seed in 1991 was generally provided by the private sector although distributed by PBDAC or co-operatives and would not likely increase in price with complete privatization.

Distribution of all cotton seeds were, up through the 1994 crop year, maintained under control of the MALR. MALR has argued that they must maintain complete control of cotton seed production and distribution to maintain variety purity. A report by Dr. Delouche, a seed consultant, disputes this assertion.[2] Dr.

---

1. See the Tranche VI report of the Agricultural Policy Reform Program, USAID/Cairo, April, 1994.

2. See the 2nd seed consultancy report of Dr. James C. Delouche filed with USAID/Cairo, August-Sept., 1993.

Delouche argues that the only currently viable alternative to cotton seed distribution by the MALR is by the cotton gins. Thus, MALR should take the necessary actions to permit the ginning companies to enter into cottonseed distribution as the gins become privatized. Privatization of cotton marketing and leasing of the cotton gins was initiated in 1994.

The 1993 price of cotton seed was increased to LE 75 per ardeb or LE 0.625/KG. This price reflects the commercial value of cotton seed and is assumed to be a very competitive price and will not increase further, except for inflation, as a result of privatization.

A very significant improvement in cotton seed was initiated by MALR beginning with the 1994 crop year with the introduction of mechanically delinted seed. The new delinted seeds were used on three varieties of cotton in seven governorates and over 169,000 feddans in 1994. The seeding rate for the new delinted seed was only 30 KG/FD compared to the usual rate of about 70 KG/FD. This reduction in seeding rate will release much more cotton seed for oil production. It is proposed that this new delinted seed will be used on 700,000 feddans in 1995 with a rate of seeding of only 25 KG/FD.

The cost of seed to the farmer has not has yet been appreciably reduced with this new technology but delinting offers the possibility to apply fungicides and insecticides to the seed and, thus, reduce other pesticide costs. Also, the reduced rate of seeding will increase the amount of seed available for crushing for oil and animal feed. A reduction in seed use from 70 KG/FD to 30 KG/FD on one million feddans of cotton is a savings in cottonseed of 40,000 tons.

Pesticides

Pesticide use in agriculture has long been subsidized by the GOE through the importation of these materials at a favorable exchange rate, the same exchange rate used to import fertilizer. In 1990 and prior to Feb. 27, 1991 the GOE imported pesticide materials at an exchange rate of LE 1.11/US$ compared to an average free market rate of LE 2.565/US$. In Feb. 1991 the GOE adopted a free market exchange rate but retained a "Primary Rate" which was to be maintained within 5 percent of the free market rate to be used to import "essential supply commodities" including fertilizer and pesticides for cotton. The use of this "Primary Rate" was discontinued in July, 1991.

But the question is "At what exchange rate were the pesticide materials purchased that were used on the crops that were surveyed during the 1991-92 seasons?" Normally, the MALR would ask for tenders for the purchase of pesticide materials during Sept- Oct. for pesticides to be used the following summer. The

exchange rate used in calculating the cost was the rate of the Central Bank in effect the day the tenders were accepted. Thus, pesticide materials used on crops grown in the summer of 1991 and winter of 1991-92 were probably purchased at the exchange rate of LE 1.11 or even earlier when the rate was LE .707.

Thus, the average expenditure estimates for pesticide materials for all crops surveyed and reported in Chapter II, except cotton, include some subsidy and were adjusted upward to compensate for this subsidy. This adjustment was 131 percent.

The situation regarding cotton is quite different. The GOE has for many years conducted a program of pest control for cotton which was completely operated by the MALR, including much heavier subsidization than for any other crops. The pest control subsidy on cotton has varied from LE 156 to LE 256 per FD in recent years including the indirect subsidy through the favorable exchange rate and the direct budget subsidies (Table 6.2). The MALR announced in early 1994 that all costs of the MALR pest control program would be borne by the producer.

Table 6.2. Cotton pest control subsidies.

	1989	1990	1991	1992	1993
			(LE/FD)		
Total costs	214.6	179.7	221.1	277.2	220.4
Subsidy	192.6	156.3	200.1	255.9	202.2

Interest on crop production loans

During 1991/92 cotton, rice, sugar crops and oil seed crops were categorized by the GOE as strategic crops which were eligible for subsidized crop production loans.[3] Under this program, limits were applied to the amount of eligible loan per feddan which would be subsidized. These limits were LE 250 for cotton and LE 200 for rice. The subsidy was the GOE payment of 6 to 8 points of the interest charge, i.e. the interest rate on subsidized loans was 10 percent compared to market rates of 16-18 percent. For a loan of 8 months on cotton and a subsidy of 8 percent on LE 250 per feddan, the subsidy totaled LE 13.33/ FD. For a 6-month loan for rice the subsidy would be LE 8 per feddan.

---

3. See Chapter 7 of the Tranche VI report, APCP policy reform program.

Interest costs were not enumerated as part of the production costs in the surveys reported in Chapter II. But appropriate interest charges on operating capital will be added to the costs reported in Chapter II at full commercial rates for the expected duration of the loan.

Fertilizer

Fertilizer is the major cash cost item on Egyptian crops and has been heavily subsidized in the past both through the exchange rate mechanism and through budgetary transfers to PBDAC to offset differences between factory prices, PBDAC operating costs, and farm level prices.[4] The GOE has gradually reduced these budget subsidies and removed all budgetary subsidies on nitrogen and phosphate fertilizers in July 1991. In this Chapter these subsidies will be accounted for, or removed, by pricing all fertilizer at 1992-93 free market prices.

In FY 1992/93 approximately 46 percent of the nitrogen produced in Egypt was in the form of urea, AN provided 46 percent of the nitrogen and the remaining 3 percent was provided by CN and AS At the prices quoted in Table 6.3, the average cost of N in the form of urea was LE 1.05/KG and LE 1.23/KG when in the form of AN for an average of LE 1.15/KG. AS, which is the primarily source of N for rice has a cost of LE 1.65/KG of nitrogen.

Table 6.3. Prices paid by farmers for fertilizer purchased from private sector merchants, 1992-93 cropping season.

Type	Summer season 1992	Winter Season 1992-93
	(LE/Ton)	
Urea	483	486
Ammonium nitrate	412	415
Super phosphate	206	205
Ammonium sulfate 1/	340	N.A.
Potassium sulfate 1/	980	N.A.

Source: Tranche VI monitoring and verification report, APCP policy reform program.
1/ PBDAC non-subsidized prices.

---

4. Actually, some subsidization of fertilizer production and transportation still occurs through pricing energy below world prices. Other subsidization may also occur though the government ownership of the domestic factories. However, the subsidy on production is hopefully accounted for, or adjusted for, by the requirements of the policy reform programs for fertilizer ex-factory prices to be comparable with border prices.

Practically all phosphate used in the form of SSP which was priced at the farm level in 1992-93 at LE 340/ton (LE 17 per sack or LE 1.37/KG of P_2O_5). The full import cost of potassium sulfate in 1992 was about LE 922/ton and with domestic transport costs, sales taxes and marketing margins, the farm price is about LE 2.00/KG of K_2O.

Table 6.4. Cost of fertilizer by crop and study area, (1992-93 free market prices).

Crop	ELS varieties	LS varieties Giza 75	LS varieties Other	All varieties
		(LE/FD)		
Cotton	144.91	117.82	137.33	129.52
Maize	132.86	134.91	141.51	136.53
Wheat	116.28	99.70	118.19	109.38
Fava beans	65.92	82.87	86.55	79.22
L. berseem	51.85	56.95	66.66	57.35
S. berseem	29.28	36.19	55.42	37.93
Rice	88.88	88.88	---	88.88

One would expect fertilizer prices to vary throughout the country as a result of transportation costs. However, at present some energy prices in Egypt are priced below international prices and also the government has a system of freight equalization which reduces these price differences.[5] Also, the public ownership, or control, of all fertilizer factories and associated government employment policies may result in some distortion in fertilizer production costs. Thus, international fertilizer prices should be used as a guide in pricing fertilizer when comparing profits from alternative crop rotations.

Irrigation cost subsidies

Another major agricultural input that has not historically been priced my market forces in Egypt has been irrigation water. The cost budgets presented in Chapter V included costs of pumping water but no fee or charge for the water itself. The long-standing policy in Egypt has been that all irrigation water is available to producers at no charge. The GOE had absorbed the costs of maintaining all water distribution structures. The only rationing device on water has been the pumping cost. Prior to the advent of diesel powered water pumps, this water was primarily pumped by animal or human power and constituted a

---

5. See Section 7.9 of "Egypt Fertilizer Policy Impact Study" by International Fertilizer Development Center, Muscle Shoals Alabama, USA, June 1993.

significant cost to the farmer. The diesel powered pump has lowered the relative pumping costs and has led to over use of water by many farmers.

No estimate of the real economic cost of water is made here but the reader should be aware that this cost has not been accounted for in any of the cost estimates presented in this report.

YIELD TRENDS

Yield data obtained in the cost of production surveys represent yields for only one production season. Yields vary from season to season due to climatic and environmental problems such as insect and disease. Long-run policy decisions should be based on long-run yields rather than actual yields, especially in only one year. Table 6.5 presents country-wide average yields over the recent 13 years for the major crops examined in this study along with some analysis of these data.[6]

The data indicate that yields of wheat, rice, maize and fava beans have demonstrated a strong upward trend during this period while cotton yields declined between 1979 and 1989 but have started to increase since 1988-89. The cause of these yield trends cannot be determined without extensive analysis of input use but it is assumed that policy reform programs initiated in 1986/87 and the use of improved technology are important causal forces. It is believed that the yield increases reported for all of these crops, including cotton during the last 3 years, resulted from better management and more care of the crop by the producers which was stimulated by better product prices. Judging by the R^2, and the standard errors of the X coefficient, the upward trend is particularly strong for wheat and maize, both increasing over 0.5 ardeb/feddan per year. The trend coefficient for rice is also very significant, both statistically and economically. Converting all crops into standard units we have an annual increase of 67 KG/FD for rice compared with 81 KG/FD for wheat, 85 KG/FD for maize, and 31 KG/FD for beans. These upward trends are not expected to increase indefinitely but to level off when the yield potential of the current technology has been reached.

As the data indicate, cotton yields trended downward from 1979/80 through 1988/89. Over this 10-year period the downward trend was 0.206 kentar/FD per year. But this trend seems to have been halted and perhaps reversed so that we can perhaps expect yields

---

6. As stated in Chapter IV, yield data for berseem is generally not available and when berseem is sold it is sold standing in the field on a per cut per kerat or feddan basis with no measure of physical quantities.

to return to the 1979/92 level. Actually, all things considered, use of the national average yields for these 5 crops in 1991/92 represents a reasonable set of yield assumptions.

These results do not show the policy maker what yield assumptions to use when comparing future returns from various crop rotations, but these trends can help to guide him to a reasonable assumption.

Table 6.5. Average yields of major crops in Egypt, (1979-1992). (Average output per feddan)

Crop Year	Wheat	Summer rice	Fava beans	Summer maize	Cotton
	(Ardeb)	(Tons)	(Ardeb)	(Ardeb)	(Kentar)
1979/80	8.74	2.44	5.61	12.00	7.17
1980/81	9.24	2.34	5.44	13.17	7.15
1981/82	9.80	2.38	6.12	13.34	7.20
1982/83	10.08	2.42	5.83	13.98	6.80
1983/84	10.27	2.27	5.69	14.46	6.77
1984/85	10.53	2.50	5.74	14.92	6.99
1985/86	10.66	2.42	9.40	14.46	6.75
1986/87	13.23	2.32	9.94	15.40	6.35
1987/88	13.31	2.55	6.42	16.00	5.52
1988/89	13.85	2.73	8.07	17.45	5.12
1989/90	14.56	3.05	8.43	18.69	5.36
1990/91	13.50	3.06	6.77	18.75	5.65
1991/92	14.99	3.22	7.06	19.20	7.15
Mean yields:					
1979-84(1st 5 yrs.)	9.63	2.37	5.74	13.39	7.02
1987-92(Last 5 yrs.)	14.04	2.92	7.35	18.02	5.76
1979-92(13 yrs.)	11.75	2.59	6.96	15.52	6.46
Regression results:					
Constant	7.984	2.120	5.541	11.430	7.351
Std. error	0.648	0.189	1.358	0.552	0.617
R^2	0.919	0.678	0.270	0.949	0.413
Trend Coeff.	0.538	0.067	0.203	0.585	-0.127
Std Err of Coeff.	0.048	0.014	0.101	0.041	0.046

HARVEST LABOR

Most crops grown in Egypt, including the crops included in this study, are produced with a labor-intensive technology. Thus, logically one would expect the labor required to harvest a crop to vary with the yield, high yields requiring more labor and low yields requiring less labor, on a per feddan basis. The surveys described in Chapter I produced data on labor use by operation and yield data. These data were used to determine if a relationship between harvest labor and yield existed and if this relationship could be quantified. The details of this analysis were provided in Chapter IV.

The statistical techniques used gave satisfactory estimates for cotton, wheat and beans but not for maize and rice. For maize and rice the best estimate of harvest labor is the same amount regardless of yield (see Chapter V). For cotton, wheat and beans the best estimate of harvest labor requirements is given below:

	Man-days /FD
Cotton:	31.3 + 1.72 X Kentar/FD
Wheat:	5.8 + 0.81 X Ardeb/FD
Beans:	12.2 + 0.41 X Ardeb/FD

As indicated, even for these crops a very large part of the harvest labor is a fixed quantity regardless of yield with labor use going up relatively little with yield. The wheat crop illustrates the greatest relative change in labor use as yield varies. In the case of wheat a yield of 12 ardeb would require 15.5 man-days versus 20.38 man-days for a yield of 18 ardeb.

PRODUCT PRICES

In any comparison of returns of alternative rotations the major variables are the product prices, in this case cotton and the major competing crops. One can look at historical product prices for guidance to the future but past prices do not always serve as satisfactory projections or guides for future prices. The price of cotton is obviously going to be a major policy variable and policy analysts must look at the cotton price in light of various other product prices. Thus, the policy analyst must simply propose a set of prices scenarios that he must examine. He can perhaps best proceed by developing certain break-even price ratios. These possibilities will be examined below.

EMODEL

All of the above adjustments for subsidies, yield considerations, and harvest labor relationships have been incorporated into a Personal Computer(PC) spread sheet model called EMODEL.[7] This model contains the following components:

INPUT PRICES
YIELDS
PRODUCT PRICES
ELS AREA BUDGETS
GIZA-75 AREA BUDGETS
OTHER LS AREA BUDGETS
CROP ROTATION RETURNS
INCOMES

All of the components on the spread sheet are interconnected. Thus, any change in any input price will automatically change the costs of any crop using that input or any change in any product price will automatically affect the total receipts of the budget producing that crop. All input prices and yields are subdivided into the three producing areas so that, for example, the price of nitrogen in areas producing ELS cotton can differ from the nitrogen price in areas producing LS cotton.

The entire model is protected[8] except for the INPUT PRICES,(Figure 6.3) YIELDS,(Figure 6.4) and PRODUCT PRICES (Figure 6.5). components. The model provides a mechanism to change labor prices, costs of machinery, costs of pesticides, land charges, general farm overhead charges and interest rates. All input quantities are given in the crop budgets. The crop budget section of the spread sheet performs the calculation of the costs and returns per feddan with the prices specified by the user in the INPUT PRICES section. This implies that input use, except for harvest labor, remains fixed per feddan for a particular crop although input prices may change.[9]

---

7. The spread sheet used was LOTUS 1-2-3. This file can be read and executed by most other IBM compatible PC spreadsheet programs.

8. The Global Protection Command in the Lotus 1-2-3 program was used to prevent accidental changes of all other parts of the spreadsheet.

9. This of course is a simplifying assumption but data are not available to estimate production functions to relate input use to output.

The general farm overhead charge of LE 21/FD is a charge for repair and maintenance of irrigation systems. This estimate was obtained from the survey of rice producers but applies to all crops equally as well as to land producing rice.

An interest charge on operating capital is calculated by the model. The annual interest rate is provided in the INPUT PRICES component and, thus, can be varied at will by the analyst. The model computes the total of all production costs except land charges. For example in the cotton budget (Figure 6.6), all costs listed above "Interest costs" are totaled by the computer. Cotton is assumed to require 8 months (2/3rds of the year) and since some costs are incurred at planting time and some at harvest time, interest is charged on only half of the total operating cost. Thus, the interest on operating capital for this cotton budget is calculated as follows:

LE 980.10 X .16 X .67 X .5 = LE 51.75

The land charge and the general farm overhead charge are fixed per feddan for all crops. Thus, this cost item does not affect the ratios of returns from the rotations but does affect the net return per feddan.

The "bottom line" of these budgets is called the "Return to LRM" which means the return to land, risk taking and management, and, after charging for land, the very bottom line is the return to risk and management. At this point all inputs have been paid including family labor, a return has been provided for land investments, a charge for the operating capital has been made and all general farm overhead expenses have been paid, thus leaving a return for the operators managerial ability and risk bearing activities.

The crop yield assumptions are listed in the YIELDS component. The yield of any crop can be varied individually in each area.

All budget results are summarized in a table of CROP ROTATION RETURNS (Figure 6.7) which allows the policy maker to easily see the impact of any variable on the returns from rotations which include cotton versus the returns from other rotations. Also, a ratio of returns is determined for each rotation using the cotton-S. Berseem rotation as the basis for comparison.

Net incomes per farm are estimated for farms from 1 to 4 feddans in each area in a table called INCOMES. The crop mix includes only the crops included in this model and were derived from the data in Tables 3.1 - 3.3.

Figure 6.1 Description of EMODEL in spreadsheet.

File name = EMODEL
File description: This file contains a set of cost and return budgets which are stratified on the basis of cotton production areas which is designed to allow the user to look at a variety of agricultural pricing policy 'what if' questions. The major output from this model is a comparison of net returns per feddan from various rotations.

A more complete description of the sources of the data and the model design is available in the APCP report titled "Cotton Supply Response Study".

This spread sheet has the following components:

A. A table of input prices. INPUTS
B. A table of product yields. YIELDS
C. A table of product prices. PRODUCTS
D. A set of crop budgets for three cotton areas,
ELS varieties, GIZA-75, Other LS varieties.
ELS BUDGETS GIZA-75 BUDGETS OTHER LS BUDGETS
E. A table of net returns per feddan for various crop rotations. ROTATIONS

These tables are linked so that changes in input or product prices will result in changes in the returns of all crops using that input or producing that product and will then be reflected in a change in the net income of the relevant crop rotations.

Total net income per farm is calculated in a table called INCOMES.

Figure 6.2. Location of model components in spread sheet.

COMPONENT	RANGES
ELS BUDGETS	A55..AB79
GIZA 75 BUDGETS	A83..AB107
INPUTS	A28..H41
OTHER LS BUDGETS	A112..AB136
PRODUCTS	Q28..S40
ROTATIONS	U28..W52
YIELDS	I28..P34
INCOMES	AB27..AE34

Figure 6.3. Example of INPUT PRICES component.

INPUT PRICES			ELS AREAS	GIZA-75	OTHER LS
Fertilizer:					
Nitrogen, (Ave. price LE/KG)			1.108	1.108	1.108
urea	LE/TON		450	450	450
AN	LE/TON		400	400	400
AS	LE/TON		340	340	340
Phosphate, SS	LE/KG of P2O5		1.367	1.367	1.367
	SSP LE/TO		205	205	205
Potassium, SOP	LE/KG of K2O		1.979	1.979	1.979
SOP	LE/TON		950	950	950
Seeds:	Crop	Units		LE/Unit	
	cotton	Kala	7.50	7.50	7.50
	rice	Kala	8.6	8.6	
	maize	Kala	2.5	2.5	2.5
	wheat	Kala	12.75	12.75	12.75
	berseem	Kala	31	31	31
	fava bean	Kala	30.5	30.5	30.5
Labor:	LE/Man-day equiv.		5	5	5
Machinery cost index			100	100	100
(Index all machinery costs with this variable)					
Interest rate (Percent)			16	16	16
Overhead expenses LE/FD			21	21	21
Pesticide cost (X base cost in 1991)			231	231	231
Land rent or charge			110	110	110

Figure 6.4. Example of YIELDS component.

YIELDS		Units/FD		
Crop	Units	ELS AREAS	GIZA-75	OTHER LS
cotton	Seed kentar	6	7.2	7.2
rice	Ton	3.055	3.055	
maize	Ardeb	19.2	19.2	19.2
wheat	Ardeb	15	15	15
fava beans	Ardeb	7.1	7.1	7.1

Figure 6.5 Example of PRODUCT PRICES component.

PRODUCT PRICES		
Crop	UNIT	LE/unit
cotton	Seed kentar	
ELS		423
GIZA-75		298
OTHER LS		290
rice	Ton	400
maize	Ardeb	65
wheat	Ardeb	75
fava beans	Ardeb	140
berseem	Cut/FD	250

Figure 6.6. Example of a crop budget in EMODEL.

CROP BUDGETS ELS PRODUCTION AREAS

COTTON

Inputs:	QT./FD	LE/FD
Seed	6.16	46.20
Nitrogen	91.14	100.96
Phosphate	29.34	40.10
Potassium	---	---
Other fert.	---	---
Manure	---	9.42
Pest control	25.52	58.95
Pest control subsidy		200.10
Pre-harvest labor	34.28	171.40
Harvest labor	41.62	208.10
Machine costs	113.32	113.32
Animal costs	---	10.55
Overhead expenses		21.00
Int. on capital		51.75
Total costs		1031.85
Receipts:		
Cotton		2538.00
Stalks		5.88
Return to LRM		1512.03
land charge		110.00
Return to Risk & Mgment		1492.03

Figure 6.7. Example of RETURNS TO ROTATIONS component.

RETURNS TO ROTATIONS		RETURN RATIOS
ELS AREAS	LE/FD	Percent of cotton-S.bers.
Cotton-S. Berseem	1599	100
Cotton- F. beans	1646	103
Rice-Wheat	1109	69
Maize-Wheat	1230	77
Rice-L. Berseem	997	62
Maize-L. Berseem	1118	70
Maize-F. beans	866	54
GIZA-75 AREAS	LE/FD	
Cotton-S. Berseem	1031	100
Cotton- F. beans	1140	111
Rice-Wheat	1062	103
Maize-Wheat	1320	128
Rice-L. Berseem	991	96
Maize-L. Berseem	1249	121
Maize-F. beans	887	86
OTHER LS AREAS	LE/FD	
Cotton-S. Berseem	917	100
Cotton- F. beans	1125	123
Maize-Wheat	1224	133
Maize-L. Berseem	892	97
Maize-F. beans	867	94

FIGURE 6.8. Example of INCOMES component.

INCOMES		
ELS AREAS		
FARM OF:	1 FD	1298
	2 FD	2595
	3 FD	3893
	4 FD	5190
GIZA-75 AREAS		
FARM OF:	1 FD	1101
	2 FD	2202
	3 FD	3304
	4 FD	4405
OTHER LS AREAS		
FARM OF:	1 FD	1025
	2 FD	2050
	3 FD	3075
	4 FD	4100

EMODEL RESULTS

Effects of input prices

Following are illustrations of the use of this model and the impacts on incomes of variations in input prices (Table 6.6). In this table the return per feddan for the cotton-short berseem (in LE/FD) is used as a base for comparison with the returns from some other rotations.

Some very drastic price variations are assumed in this comparison. This does not imply that such changes are likely to occur but only to illustrate what the impact would be on the income of cotton versus other crops.

Table 6.6. Comparisons of returns to crop rotations under various input price scenarios.

Area and Rotation	Base prices	Fert. +100%	Labor +100%	Machinery +100%	Land +200%
AREAS PRODUCING ELS VARIETIES			(LE/FD)		
Cotton-S. berseem	1,599	1,420	1,142	1,463	1,159
	(Percent of income from Cotton-S. Berseem)				
Cotton-F. beans	103	101	96	95	104
Rice-wheat	69	66	75	44	58
Maize-wheat	77	69	82	66	68
Rice-L. berseem	62	61	62	43	48
Maize-L. berseem	70	65	69	65	58
Maize-F. beans	54	47	49	42	37
AREAS PRODUCING GIZA 75			(LE/FD)		
Cotton-S. berseem	1,031	874	558	840	591
	(Percent of income from Cotton-S. Berseem)				
Cotton-F. beans	111	107	105	102	118
Rice-wheat	103	99	146	71	105
Maize-wheat	128	124	178	125	149
Rice-L. berseem	96	95	125	74	93
Maize-L. berseem	121	121	158	127	137
Maize-F. beans	86	76	95	76	76
AREAS PRODUCING OTHER LS VARIETIES			(LE/FD)		
Cotton-S. berseem	917	720	379	715	477
	(Percent of income from Cotton-S. Berseem)				
Cotton-F. beans	123	124	139	114	144
Maize-wheat	133	134	239	125	164
Maize-L. berseem	97	99	137	90	95
Maize-F. beans	94	88	139	82	89

The base prices for inputs and products are given in Figures 6.3 and 6.5 respectively. (The base yields are given in Figure 6.4.) With these base prices, cotton is by far the most profitable crop in the ELS areas.[10] In areas which produce Giza 75, cotton competes on a par with rotations which include rice but gives slightly lower returns than rotations which include maize. In areas producing other LS cotton varieties, cotton does not compete with maize-wheat but is slightly ahead of the other rotations.

If all fertilizer prices were to double, net incomes of all crops would decline including a decrease of LE 150-200 per feddan of cotton. However, compared with other major crop rotations cotton would generally gain in competitiveness.

Because of the relatively large labor requirements of cotton, a doubling of the cost of labor from LE 5/day to LE 10/day would improve the competitiveness of non-cotton crops. But with ELS cotton the attractive cotton price still keeps cotton very competitive. This is not the case with the LS varieties where cotton-S. berseem becomes the least profitable rotation except for the maize-beans rotation in the Giza 75 areas.

On the other hand if machinery prices doubled cotton would gain ground relative to other crops due to its dependence on labor. Rice loses ground here because of the high level of mechanization of rice production, compared to other crops.

If land rents increased by 200 percent, net returns to risk and management would drop drastically. But notice that this type of cost increase does not change the **relationships** between any rotations, only magnifies the differences. Note that with a high land charge the ratios that were less than 100 are now smaller and those greater than 100 are now larger.

Effects of product prices

One can examine a multitude of product price scenarios. If crops were not in produced in rotations than cotton could simply be compared with other summer crops and one could ignore the prices of the winter crops. This is not the case. The competitiveness of cotton with maize or rice also depends upon the prices of the winter crops, such as berseem, wheat and beans.

---

10. The cotton prices included in this example are the average 1992 decreed prices per metric kentar of cotton lint. This price is actually below the price received by the producer because this price does not reflect the ginning outturns.

ELS COTTON

Table 6.7 provides some comparisons of returns with various product prices for the ELS cotton areas. The first column gives the results with the product prices as reported in Figure 6.5. which will serve as a basis for comparison. As indicated above, this includes a price for ELS cotton at LE 423 per seed kentar which was the decreed price for lint cotton for the 1992/93.[11] At this price level the cotton rotations give returns that are about 30 percent greater than the non-cotton rotations. Note that comparisons are not made with vegetable or fruit crops which would be expected to produce higher returns than cotton rotations, but all land used for cotton could not be expected to be used for the production of fruits or vegetables.

Table 6.7 provides additional estimates of returns with ELS cotton prices ranging between LE 322 and 362/kentar. With a cotton price of LE 362, the net return from the maize-wheat rotation is equal to that of cotton-s.berseem and at a cotton price of LE 341, the returns from the rice-wheat and maize-berseem rotations are equal to the cotton-berseem rotation. Thus, by varying the product prices one can calculate prices that give 'break-even' returns for each alternative rotation.

Table 6.7. Comparisons of returns to crop rotations under various price scenarios for ELS cotton.

Rotation	Base 423	ELS cotton prices 334	322	341	362
			(LE/FD)		
Cotton-S. berseem	1,599	1,065	993	1,107	1,233
	(Percent of income from Cotton-S. Berseem)				
Cotton-F. beans	103	104	105	104	104
Rice-wheat	69	104	112	**100**	90
Maize-wheat	77	116	124	111	**100**
Rice-L. berseem	62	94	**100**	90	81
Maize-L. berseem	70	105	113	**101**	91
Maize-F. beans	54	81	87	78	70

Table 6.8 provides a comparison for the ELS areas where the cotton-S.berseem rotation is compared with the rice-L. berseem rotation. Here break-even prices were determined for cotton when the price of rice was varied in LE 25 increments and for two different prices for berseem. With berseem priced at LE 250 per cut and rice at LE 375, the rice rotation gives a net return of LE 921 per feddan of land, and, thus, ELS cotton must be priced at LE 310 per kentar to give the same return per feddan.

---

11. Cotton produced in 1992 and marketed in 1993.

With each increase in the price of rice of LE 25/ton the net return per feddan of rice increases by about LE 75 and to be competitive, the cotton price must increase by LE 13/kentar. Increasing the price of berseem puts cotton at a disadvantage since short berseem produces only about 2 cuts versus about 4 cuts for long berseem. Thus, with berseem at LE 300 per cutting per feddan, and rice at LE 375/Ton, the break even cotton price is LE 323/kentar. Similar comparisons can be made with other crops and for the other cotton areas. Whenever a yield assumption is changed or an input price is changed, the break-even calculations may give different results, but as shown in Table 6.6, drastic changes in input prices had little impact on the relative competitive position of the crops.

Table 6.8. Comparisons of returns from ELS cotton versus rice under various price scenarios.

	With a rice price of:	Break even cotton price is:	Net Return LE/FD
With Berseem at LE 250/cut			
	375	310	921
	400	323	999
	425	336	1,075
	450	349	1,150
With Berseem at LE 300/cut			
	375	323	1,100
	400	336	1,178
	425	349	1,254
	450	362	1,334

GIZA-75

Table 6.9 presents similar price comparisons for areas producing Giza 75. Here we see that the 1992/93 prices of cotton gave returns roughly comparable to that from other rotations. The 1991/92 price for Giza 75 of LE 277/kentar put cotton in a non-competitive range. Farmers in areas allowed to produce Giza 75 could make more money in 1991/92 producing any other rotation which excluded cotton. The break-even prices for three other rotations were given in this table.

OTHER LS COTTON VARIETIES

Returns from various rotations are presented for areas producing other LS cotton varieties in Table 6.10. As with Giza 75, the 1992/93 prices of other LS varieties made income from cotton roughly comparable to that of other crops. The 1991/92 price was only LE 10 less which put the cotton-s.berseem rotation below

that of maize-beans and maize-berseem. A much higher cotton price is needed to make the cotton-berseem rotation competitive with the maize-wheat rotation in any LS producing areas.

Table 6.9. Comparisons of returns to crop rotations under various price scenarios for Giza 75 variety, LS cotton.

Rotation	Base 298	Giza 75 cotton prices 277	292	329	338
			(LE/FD)		
Cotton-S. berseem	1031	880	988	1254	1319
	(Percent	of income	from	Cotton-S.	Berseem)
Cotton-F. beans	111	112	111	109	108
Rice-wheat	103	121	108	85	81
Maize-wheat	128	150	134	105	**100**
Rice-L. berseem	96	113	**100**	79	75
Maize-L. berseem	121	142	126	**100**	95
Maize-F. beans	86	101	90	71	67

Table 6.10. Comparisons of returns to crop rotations under various price scenarios for other LS cotton varieties.

Rotation	Base 290	Other LS cotton prices 280	283	287	332
			(LE/FD)		
Cotton-S. berseem	917	845	867	896	1220
	(Percent	of income	from	Cotton-S.	Berseem)
Cotton-F. beans	123	125	124	123	117
Maize-wheat	133	145	141	137	**100**
Maize-L. berseem	97	106	103	**100**	73
Maize-F. beans	94	103	**100**	97	71

In summary, one can conclude from these calculations that the 1992/93 cotton prices gave cotton a very definite advantage over other crops in the ELS producing areas but the 1992/93 prices put cotton about on a par with other crops in the LS producing areas.

Impact on incomes

The policy maker must not only be concerned with shifts in production in response to prices changes, i.e. supply responses in cotton production, but he also must be concerned with the effects of the price changes on net farm income. This component deals with the crop income but excludes the value of family labor since in the model all family labor is considered as an expense.

The INCOMES table (Figure 6.8) provides estimates of net income for farms with one to four feddans of land. This table is linked to the other model components and is based on a fixed pattern of crops in each area. As relative prices change the crop mix is expected to change and hence the equations that calculate the net incomes in this component would need to be changed.

This component of the model does not adequately deal with the income question since incomes of rural people are also affected by earnings from off the farm, by livestock prices, and by many other variables. This effort should not be considered as an adequate estimate of rural incomes.

Short Season Cotton:

The recent declining international prices of ELS varieties indicates a possible need for Egypt to shift to shorter staple cotton varieties. Also, Egypt is currently importing shorter staple cottons to meet the needs of its cotton textile industry.

Shorter staple cottons can be produced by shorter season cotton but in fact it has been shown that long staple varieties can also be produced in a shorter growing season.[12] The most obvious advantage of a shorter growing season for cotton is that the growing season for the crops produced during the winter or late fall in the cotton rotation is longer and allows more choice of crops. In the simplest case, a 7-month growing season for cotton would allow the production of 3 cuts of berseem instead of the present usual of 2 cuts, and a 6-month growing season for cotton would allow 4 cuts of berseem.

These alternatives were examined with the EMODEL and the results are given in Table 6.11.[13] For example, with two cuttings of berseem in the Giza 75 areas the cotton/berseem rotation gives an income equal to the rice/wheat rotation at a cotton price of LE 302/kentar. But with 3 cuts the break even price of cotton would be LE 261 and with 4 cuts the break even price would drop to LE 231/kentar. Clearly, any shortening of the growing season makes the cotton rotation much more competitive.

---

12. "A. Anwar Abdel Bary and M. Ali Bishir. "Alexandria 5, An Extralong Egyptian Cotton", in the Egyptian cotton Gazette, No. 98, January 1992. Pages 7-15.

13. A study of the economic and technical feasibility of producing shorter season cotton, and presumably shorter staple cotton, sponsored by USAID with ARC/MALR scientists is currently under way. This study will explore the technical and economic constraints on a number of alternative cropping rotations with shorter season cotton varieties.

Table 6.11 Break-even prices of cotton with other rotations with various number of cuttings of berseem.

Cotton area and other rotations	No. cutting of berseem: 2 cuts	3 cuts	4 cuts
Giza 75 areas:			
Rice/wheat	302	261	231
Maize/wheat	338	297	266
Maize/wheat	329	287	257
Other LS areas:			
Maize/wheat	333	304	273
Maize/berseem	287	258	227

Another way of looking at this is that each cutting of berseem is worth about LE 250/ feddan, so net income would increase by LE 220/FD (LE 250 minus LE 30 labor costs.) with each additional cut of berseem.

If the cotton growing season could be shortened sufficiently so that wheat could be grown in rotation with cotton this rotation would give profits far greater than any other rotation examined here. The net income from wheat exceeds that from short berseem by LE 410 to LE 565 per feddan with wheat at LE 75/ardeb and berseem at LE 250/cut. Thus, the wheat-cotton rotation could increase wheat production in Egypt by approximately 50 percent with associated declines in necessary wheat imports with no decline in cotton production, but of course a large decline in berseem production.

ANNEX I. MALR SYSTEM FOR MAINTAINING YIELDS IN EGYPTIAN COTTON VARIETIES

The Agricultural Research Center of the MALR carries on a varietal maintenance program at the Sakha Research Station on a special block of land that is physically isolated from all other varieties and lines of cotton by an appropriate distance. This system used by the "Cotton Varietal Maintenance Section", Cotton Research Institute can be outlined as follows:

- 1) The first year many single plant selections are made from the different families that make up the variety.

- 2) The second year a large number of progeny rows are grown from those selections which pass the laboratory tests

- 3) The third year a replicated performance trial, and small increase blocks are grown.

- 4) In the fourth year seeds from superior families are mixed to form the breeder seed for the increase, conveniently called 'nucleolus' in the Egyptian nomenclature.

- 5) In the fifth year the nucleolus is further increased to plant the 'nucleus' which forms the original source of subsequent propagation and commercial stocks. This is also called the "Foundation" seed. The 'nucleus' carries the number of the year in which it was propagated.

Using the above procedure the Agricultural Research Center provides the breeder and foundation seed from which certified seed is produced. Certified seed is produced by contract farmer growers under the control of the Central Administration of Seeds(CAS). The CAS chooses the contract fields, monitors the progress of the crop, roques the fields prior to harvest, supervises the ginning in one-variety gins to assure seed purity, and then transfers the seed to PBDAC or the co-operatives for sale to the farmer.

References:

1. Abdel-Malek, K.K.I. and M.M. El-Razaz. 1991. Response of Giza 83 cotton cultiver to some cultural practices. Minia J. Agric. Res. & Dev. Vol. 13 no. 3 September 1991.

2. Al-Didi, M.A. 1982. The cotton research institute and the evolution of Egyptian cotton varieties. The Egyptian cotton gazette. P.P. 101 - 106.

3. International Cotton Advisory Committee 1988. Cotton produced by type. Report prepared by the secretariat for the 47th. plenary meeting of the ICAC. Lima, Peru, October 1988.

4. Lewis, C.F. 1970. Concepts of varietal maintenance in cotton. Cott. Gr. Rev., 47:272-284.

5. Moore, J.H. 1941. The influence of any internal genetic change in a standard variety of cotton upon fiber length. Jour. Amer. Soc. Agron., 33:679-683.

6. Moore, V.P., and J.B. Dick. 1950. Test quality of cotton four generations removed from breeders foundation seed. Miss. Farm. Res., 13 May, 1950.

7. Mostafa, M. Samir 1976. Some aspects of breeding method for maintaining Egyptian cotton varieties. Ph.D. Thesis, Fac. Agric., Al-Azhar university.

8. Mostafa, M. Samir, Ahmed - Raheem, M.A. Naguib and A.R. Hamed. Integrated pest control in Egypt. Crop protection. 44th. plenary meeting of the ICAC. Doc. 8:35-40. Sydney - Australia, October 1985.

9. Mostafa, M. Samir, m. Al-Didi and M. E. Abdel Salam. 1988. Quality control in the cotton product. Report prepared by the secretariat for the 47th plenary meeting of the ICAC. Lima, Peru, October, 1988.

10. Mostafa, M. Samir. 1989. The leader of all cottons. Cotton International. 56th Annual Edition, 186 - 187.

11. O'Kelly, J.F. 1942. Degeneration within cotton varieties. Jour Amer. Soc. Agron., 34:782-796.

12. Simpson, D.M. and E.N. Duncan. 1953. Stability of cotton varieties. Agron. Jou., 45:448 - 450.

Definitions:

Lint percent: The relative amount of lint in seed cotton expressed in percentage.

$$\text{Lint percent} = \frac{\text{Lint weight}}{\text{Seed cotton weight}} \times 100$$

Seed Index: the weight of 100 seeds in grams.
Lint Index: The weight of lint borne by 100 seeds in grams.
1 Seed Kentar = 157.5 Kg of seed cotton.
1 Metric Kentar = 50 Kgm. of lint = 110.23 pounds.
1 Ardab = 120 Kg. or 12 kala of cotton seed.
1 Feddan = 1.038 acres = 4200.856 sq. meters.

ANNEX II

COTTON SURVEY QUESTIONNAIRE

COTTON SUPPLY RESPONSE STUDY
SURVEY OF 1991 COTTON PRODUCTION TECHNIQUES AND COSTS

I. IDENTIFICATION:

Governorate:_____District:_____

Village:_____

Name:_____

Total land in holding:

Feddans	Kerat

Date of planting of cotton, 1991.

Month_____week_____.

II CROP HISTORY

Crop plantings:

Winter season 1990/91 | Summer 1991

Crop	FD	Kerat	Yield	Crop	FD	Kerat	Yield

Winter season 1991/92

Crop	FD	Kerat	Yield

III. LIVESTOCK INVENTORY

	No. of breeding age	No. non-breeding age
Buffalo		
Beef cattle		

	Total no, of animals
Donkeys	
Goats	
Sheep	
Camels	

IV. INPUTS USED IN COTTON PRODUCTION, 1991.

Input	Unit	quantity	Price per unit
Seed			
manure			
Chemical fertilizers:			
Urea			
Amm. nitrate			
Amm. sulfate			
Cal. nitrate			
SSP			
TSP			
K2O			
Other			

V. Animal, Machinery and Labor INPUTS ON COTTON, 1991

Operation	Animal: costs LE***	Labor(total days) * Man Fam.	Man Hire	Woman Fam.	Woman Hire	Child Fam.	Child Hire	Wage** rates M	W	C	Mach. costs LE***
apply manure											
plowing											
leveling											
making rows											
making borders											
seeding											
irrigation											
weeding											
apply fert.											
pick cotton worms											
apply insecticides											
1st cotton picking											
2nd cotton picking											
3rd cotton picking											
transport cotton											
cut stalks											
transport stalks											
other											

* - Record no. of days times number of people to give total days
**- Include all benefits.
***- Based on rental rates.

ANNEX III. SCOPE OF WORK OF ORIGINAL STUDY TEAM

COTTON SUPPLY RESPONSE

SCOPE OF WORK

Problem

The GOE has followed the policy of fixing area quotas, compulsory delivery to publicly-owned gins and spinning mills, and setting farm-level procurement prices substantially below border price equivalents, combined with partially offsetting subsidies to inputs in cotton production. Parallel with the cotton subsector policy has been a corresponding policy with respect to the downstream processing of cotton lint into cotton yarn and woven and knit cotton fabrics. The intermediate steps of ginning and cotton lint marketing were handled on a service (i.e., cost) basis. The main downstream policy component has been the effective transfer of the surplus of the surplus gained from taxation of cotton production to the spinning mills as subsidy to the production of cotton yarn. This policy action can be viewed as preference for exporting processed cotton in the form of yarn, cloth and garments as against the export of cotton lint as well as a mean of subsidizing domestic consumption of processed cotton.

Thus, policies concerning cotton production and cotton spinning are linked. Each LE of reduction in the cotton production tax is matched by an LE of reduction in the subsidy for cotton spinning. In consequence, effective structural adjustment of the combined cotton and textile subsectors has been slowed as decision makers in each sector have conflicting goals. Meanwhile, the taxation of cotton production, both through an over-valued exchange rate, which acts as an implicit export tax, and the low procurement prices, which act as an indirect tax on cotton production, have induced a long term decline in cotton production and cotton exports. This decline worked primarily through a reduction in yield per feddan from 8.5 to 5.8 metric kentars. In addition, some technical factors such as pest infestations and a possible decline in the vigor of some varieties may have contributed somewhat to the yield decrease.

The decline in cotton production has resulted in the allocation of an increasing proportion of domestic production to domestic spinning mills. In turn, this has resulted in the use of high quality ELS and LS cotton varieties in increasing quantities in the production of coarse, low value yarn which demands premium cotton lint input. This dilemma stems from past low investments which have left a legacy of low productivity and low capital utilization in cotton spinning, despite heavy input subsides (for cotton lint and energy). This mismatch between quality of cotton output and optimal inputs to existing spinning capacity has led in recent years to the growing use of imports of lower quality cotton grades in domestic spinning or order to capture some of

the arbitrage gain from being able to export high quality Egyptian cotton to purchasers able to exploit its premium characteristics.

Clearly, the resolution of the dilemma requires a decoupling of domestic cotton production from domestic cotton spinning. This requirement implies paying the price to break-up the tax subsidy transfer that is the basis of the zero sum game between the two subsectors. One mechanisms for accomplishing the needed decoupling over approximately fiveåyears was suggested in the Cotton and Textile Sector Study for Egypt done by the World Bank (May 1991). This scheme proposes a move to a border price basis combined with a short run optimal export tax on cotton lint that would be set initially at 33% (for ELS varieties) and 23% (for LS varieties). These short run taxes would be reduced annually by a few percentages points over about five years until reaching the long runs levels of 10% (ELS) and 0% (LS). Of course, other schemes can also be designed. Clearly, the essential element in any such schemes is placing domestic prices for cotton on a border price basis.

Background:

Previous analysis and negotiation under the APCP Policy Component have focused on the agricultural sector per se. In consequence, important downstream linkages of the kind discussed in the problem statement above have usually been swept under the rug. Clearly, the zero sum game over resource transfers between cotton production and cotton spinning is the type of linkage for which interministerial agreement in GOE is essential if progress is to be made.

In 1986 and 1987, following several years of analysis and negotiation, the policy component of the APCP project formulated a series of reform benchmarks. A system of three annual cash disbursement was set up, each disbursement being make upon completion of agreed benchmarks. The benchmarks included elimination of price, area and marketing controls on all crops except cotton sugarcane and rice; removal of crop processing and marketing controls, except for cotton, sugarcane and rice; reform of cotton, meat and feed pricing and marketing restrictions; and initiating dialogue on reforms in the farm inputs sector.

Major accomplishments were: eliminated price, acreage and marketing controls for 10 crops; opening citrus exports tot he private sector; slight increases in prices of sugarcane, cotton and rice; study of PBDAC's input marketing activities, with recommendations for divestiture, increase in fertilizer prices by 75%; and freezing credit subsidies at LE 105 million. The above reforms show real progress toward the long-term target of fully liberating the Egyptian agricultural economy.

Key remaining problems, carried into Phase II of the APCP Policy Component, were: cotton prices were still well below border prices; rice delivery quotas and marketing restrictions still existed; inputs subsidies had not been fully removed; PBDAC was still heavily involved in input distribution; and the government still controlled the activities of the cooperatives.

The first tranche of Phase II for APCP has been completed with somewhat mixed reform results. Cotton prices fell short of the interim target for both tranches 4 and 5 but rice quotas were eliminated ahead of schedule. Feed subsides are being reduced on target; some fertilizer and other inputs are being traded by the private sector; adjustment was made in the structure of credit subsidies; and a barely satisfactory plan for disengaging the government from the affairs of the cooperative was developed.

Two factors probably account for the apparent lag in GOE compliance with medium-term policy reform targets. First, the Ministries of Industry, Economy and Supply are not nearly as willing to liberate agricultural markets as are their counterparts in the Ministry of Agriculture. Second, there is uncertainty about private sector capacity to take over from public institutions, and a genuine reluctance to subject farmers to market risk.

Part of the solution for both negative factors lies in developing a convincing analysis of the costs and returns of reforms, and in presenting the results to decision-makers in the concerned Ministries. In particular, in the case of cotton, producer response to various price scenarios must be analyzed and net returns to processing and exporting at various projected levels of domestic production must be estimated.

The scheme for breaking up the zero sum game between cotton production and cotton spinning discussed above in the problem statement may offer a way out of the present impasse. However, as sketched above, it leaves some worrisome questions that need to be answered. In particular, what will be the supply response of cotton farmers to the gradual liberalization of cotton prices under the export tax reduction schedule over the horizon of five years or to some alternative schemes of increasing farm prices? Assuming the response is positive, will labor supply or other input constraints tend to limit the magnitude of the response? if the response should be negative, due perhaps to offsetting effects of input supply liberalization, what should be appropriate policy remedy?

Overall Objectives:

The central objective is to estimate the cotton production resource allocation and income implications of raising the cotton procurement price to its border price equivalent (with long-run

optimal export tax on ELS varieties). Secondary objectives include estimation of other changes in crop and livestock outputs and estimating the net economic impact on agricultural income and employment of the change in cotton procurement price policy.

Specific Objectives and Methodology:

The key task is the development and use of multi-market simulation model to estimate supply responses to procurement price and other cotton subsector liberalization actions. Note that such actions represent significant discontinuities with the previous cotton policy regime. This means that estimation of farmer supply response cannot rely on econometric supply functions since the values of the parameters of such functions will necessarily be conditional on the previous policy regime. This is the essence of the now famous "Lucas critique", which places significant constraints on the relevance of reduced farm supply functions estimated from time series data generated under a different policy regime. The methodology to be used avoids this problem by relying on an activity analysis representation of cotton production possibilities, i.e. a vector of input-output coefficients defines a discrete point on a production function defining the maximal feasible production (multiple input, single output) given existing technology. The state of technology depends on the current state of technical understanding on the part of farmers, and this will shift over time as technical understanding itself advances and as farmers gain an understanding of given technology. A set of input-output vectors provides a set of points on the currently relevant production function for a given agricultural commodity, and in this sense is an approximation to a full description of the production function.

The study will utilize a multi-market simulation model utilizing an activity analysis representation of production possibilities that will be an updated and specialized version of a previous model of this type, the Kutcher-McCarl model. The model will simulate a competitive equilibrium in a set of related agricultural commodity markets by maximizing the sum of producer and consumer surplus. Policy changes are embedded in the equations of the model, and a set of solutions each embodying a single policy change or discrete sets of policy changes can be used to characterize the cotton farmers response to change in policy regime. This is possible because the supply and demand relations embedded in the model are structural approximations to profit and utility maximization by representative producers and consumers. These responses are constrained but not distorted in the sense of misrepresentation of consumption and production possibilities across solutions embodying different policy changes. The revision of the Kutcher-McCarl model will not only update the input-output coefficients of the activity vectors but also seek to enlarge the set of activity vectors per included

commodity insofar as this will be possible in the time available. In addition, the treatment of livestock production (and its linkage to cropping) and the agricultural labor supply will be extended to capture more fully the interdependence among agricultural activities. Given that the fodder crops are major competitors to cotton for scarce agricultural resources and an expansion of cotton production may be constrained by rising wages, particularly for labor-intensive tasks such as picking, estimated cotton supply response my be sensitive to these extensions.

Tasks:

I. Examination and Assessment of Existing and Proposed Data Collection

   A. Analyze the farm survey data (March 1992) which quantified coefficients of production for cotton and competing crops for 750 cotton producers.

   B. Detailed assessment of present cotton production system (Assess present controls, taxes, subsides, mandated institutional arrangements with respect to cotton production, marketing and ginning; assess over time the regional distribution of production of cotton varieties and related farmer supply response; assess role of village cooperatives; assess impact of input subsides; assess effect of ginning costs and by-product handling on farmer returns.)

   C. Collect other farm and market data as may be required for development of multi-market model.

II. Develop a multi-market, market equilibrium simulation model of the Egyptian Agricultural sector in order to estimate the impacts of various scenarios with respect to cotton subsector liberalization.

   A) Model construction. (this involves re-estimation of an existing model to specialize it for the questions to be studied with reference to cotton production response).

   B) Calibration and Verification of baseline solution.

   C) Simulation of Policy Scenarios:

      i. Response to 1992 cotton price adjustment

      ii. Response to expected price adjustments for 1993-1996

   D) Analyze and Describe the simulation results in a paper.

III. Develop, in coordination with the cotton liberalization study, a Time Phased Plan for removing the controls over cotton production, e.g. acreage quotas, mandatory marketing ginning arrangements, procurement prices, and input subsides. The Plan should keep economic and social dislocations to acceptable levels, and take into account the present state of the private sector in Egypt and its likely evolution under liberalization.

IV. Develop estimates of accurate supply and prices, given estimates of world demand by variety being prepared under the Cotton Liberalization Study.

Deliverables and Resources:

One interim report and a final report are required. The interim reports will be due on September 1, 1992, summarizing field survey results, preliminary data analyses and presenting supply response estimates. A final report is due in October 1992 which presents the analyses, develops recommendations relevant to remaining policy issues in the cotton subsector, and provides conclusions on the objectives of the study.

Level of Effort:

The study will span five months during which approximately four months will be funded under APCP, one short-term expatriate specialist for four months; four national experts, a secretary and 20 field enumerators for the four months will comprise the study team. A long term production economist, funded under Chemonics will devote approximately two person-months to the level of effort.

Technical Requirements of the Team:

Expatriate:

Development Economist, Team Leader. Ph.D. in economics or agricultural economics with ten years of analytical experience, at least five of which addressed economic policy problems in developing countries. A sound grasp of economic theory as applied to agricultural supply, and stability to apply advanced techniques of econometrics and quadratic programming to agricultural data, is required. Demonstrated capability in both macro-economic and micro-economic analysis is required.

Egyptians:

1. **Development Economist:** Ph.D. in economics or agricultural economics and at least 10 years of experience analyzing agricultural policy issues in Egypt. Specific experience in the cotton industry would be highly desirable. The expert should be experienced in applying advanced statistical and programming techniques to analysis of agricultural supply functions.

2. **Livestock Economist:** M.S. or Ph.D. in agricultural economics, specialist in farm management. At least ten years of experience in analyzing Egyptian farmer behavior with respect to crop choices, inputs decisions, farm income and costs, farm prices and farm employment.

3. **Labor Economist:** M.S. or Ph.D. in economics with specialization in agricultural labor problems. At least ten years experience in analyzing farm labor issues in Egypt.

4. **Cotton Production Specialist:** M.S. or Ph.D. in agronomy or related field, with specialization in cotton production. At least ten years of experience in Egypt in breeding, cultivation, crop management, soil science, or plant pathology, as related to cotton.