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KAFR EL SHEIKH FARM MANAGEMENT SURVEY

CROP ENTERPRISE BUDGETS AND PROFITABILITY ANALYSIS

By

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KAFR EL SHEIKH FARM MANAGEMENT SURVEY, CROP ENTERPRISE BUDGETS AND PROFITABILITY ANALYSIS

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ABSTRACT

This report is divided into three main sections:

The first section provides information about the content and the procedure of the Farm Management Survey conducted at Abu Raya site, Kafr el-Sheikh Governorate, in January 1981. The survey questionnaire was tested on eight farmers and a total of fifty farms were surveyed after pre-testing the questionnaire.

The second section discusses the crop enterprise budgets for the main crops at Abu Raya site. A discussion of the methodology used in developing the three major parts of the budgets is included.

The third section focuses on a preliminary profitability analysis. The profitability of major crops per *feddan* accounting for all cash and non-cash expenses is measured attributable to the farmer. Since the water is provided to the farmers free of charge, the net income can be used as a measure of estimating returns per cubic meter of water applied. This estimation does not represent the value of water in production of these crops.

75 pages 28 tables

مستخلـــــص

هذا التقرير يحتوى على ثلاثة أقسام رئيسية :

- القسم الأول ويعطينا فكرة عن محتويات حصر الادارة المزرعية الذى تم اجراؤه فى يناير ١٩٨١ بمنطقة أبو ريا ، محافظة كفر الشيخ . كذا يشرح خطوات اجراء هذا الحصر فيوضح ان استمارات الحصر قد اختبرت أولا بالنسبة لثمانية من المزارعين ثم اجرى هذا الحصر مع خمسون مزارعا بعد ذلك .

- القسم الثانى يناقش دراسة التكاليف والعائد للمحاصيل الرئيسية بمنطقة أبو ريا والمنهج المستخدم فى الأقسام الثلاثة الرئيسية لهذه الدراسة .

- القسم الثالث ويركز على دراسة مبدئية للأربحية العائدة من المحاصيل الرئيسية بالنسبة للفدان الواحد وذلك بحساب المصروفات النقدية والغير نقدية كما أن هذا القسم يذكر انه لما كان ماء الرى يقدم للزراع مجانا فان صافى الدخل يمكن استخدامه كمقياس فى تقدير العائد لكل متر مكعب من ماء الرى المستخدم مع ملاحظة أن هذا التقدير لايمثل قيمة أو ثمن المياه فى انتاج هذه المحاصيل .

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SECTION I

FARM MANAGEMENT SURVEY

Introduction

Farm management surveys were conducted in Kafr El-Sheikh and Mansuriya sites on January and February of 1981. The survey questionnaires were designed to collect information on various economic facts of the irrigated farming systems of these two areas. The specific areas of focus of these surveys were the availability of resources, production practices, quantities of inputs used and outputs generated, prices, and economic and institutional constraints under which these farmers operate.

Farm management survey of a representative sample of farms is a reliable method of collecting information on economic aspects of a particular farming system. A simple arithmetic mean of various data from the surveyed farms can be used to construct a representative farm. A representative model of the existing farms provides the background information whereby the impact of various improvements in irrigation systems and practices such as land leveling and appropriate timing and level of water application on farm output and economic well-being of the Egyptian farmers can be assessed. Further study of the representative farms through consideration of various changes in the availability of resources, input and product prices, and institutional constraints can provide useful information for guiding the implementation of various irrigation practices.

In addition to building a representative farm model, the survey data can be used to highlight the differences that exist between farms. Knowledge of the differences in farming practices and the resulting outcomes can be a valuable means of identifying problems and assessing the degree of improvement in output and farmers' income that can be achieved (Upton, 1973).

The information brought together in this and the following survey papers can be directed toward the evaluation of the costs of irrigation related problems and the possible benefits from the introduction of improved water management system.

Use of the survey for collection of data for an entire cropping season or cropping year makes it difficult to obtain accurate and detailed information on all farm enterprises. This problem can mostly be attributed to difficulty by farmers to recall past transactions and production activities. It is particularly difficult to obtain accurate information on inputs such as labor which are utilized continuously throughout the year and outputs such as vegetables and milk that are produced, marketed, and consumed throughout the production season.

These problems can be partly resolved by focusing on major crop enterprises and production practices. Supplementing the survey with farm records on a representative sample of farm is a valuable means of collecting more accurate and detailed information on continuous production activities (Abdel Al and Skold, 1980). Farm records can also be used to identify problems with the case study farms, test various programs, and assess the consequent improvements. The impact of a

wider range implementation of various programs in a farming area can, however, be more appropriately evaluated by use of survey data.

Questionnaire Design

The farm management survey for Abu Raya, Kafr El Sheikh, was conducted by a single visit approach. The questionnaire was specifically designed to collect data on two cropping seasons (1980 cropping year). Review of farm records and visits with farmers and EWUP staff at Kafr El-Sheikh site provided the information required for constructing the questionnaire.

The questionnaire was organized in a tabular form in order to facilitate cross check of farmers' responses during the survey. All major inputs, sources of inputs, production activities, outputs and their uses were listed in the questionnaire in order to assure that the data was uniformly collected from all the farms that were surveyed. The questionnaire was initially written in English and then translated to Arabic in order to facilitate data collection by the survey team (Appendix D).

The questionnaire was improved and simplified following the testing of the questionnaire on eight farmers. The final version of the questonnaire consisted of twelve sections. The collection of data categories for which these sections were designed are as follows:

1. Farm size, land ownership and land rental practices.
2. Crops produced in the winter and summer seasons, crop rotation, yield, crop disposition and prices.

3. Animal species owned, marketing practices and livestock value.

4. Crop residue and animal by-products production, uses, and value.

5. Water availability along the mesqas.

6. Water lifting practices.

7. Fertilizers, pesticides and supplementary animal feed purchases from cooperatives, markets and their respective prices.

8. Seeding rate and application of fertilizers by crop.

9. Use of tractor and animal in land preparation activities.

10. Farm family labor force and off-farm employment.

11. Labor utilization and labor hiring practices in various farming operations by crop.

12. Farmers' views on: (a) profitability of different crops and livestocks, (b) substitution of tractor and pump for draft animal, (c) adequacy of inputs provided by the cooperatives; and (d) appropriateness of the crop rotation system.

Survey Procedure

The farm management survey was conducted by the Egypt Water Use and Management Project's interdisciplinary team at the Kafr El-Sheikh site. Participation of this group in the survey proved valuable due to their familiarity with the irrigation and farming system of the area. The survey team was familiarized with the purpose and structure of the questionnaire and received training on the methodology of administering the questionnaire.

The questionnaire was tested on eight farmers. Following the test, a number of changes were made in the questionnaire in order to

increase the accuracy of data collected and the efficiency of administering the questionnaire. The testing phase for the questionnaire also provided valuable practical training to the survey team.

The farms surveyed were selected by the survey team as they randomly located the farmers in their fields and villages. This selection process was, however, constrained by the following two criteria:

(1) the farms selected for the survey should be located within the Abu Raya cooperative district.

(2) the survey should obtain an approximately equal representation from the farms that are located in the beginning, middle, and end of the water courses.

The survey was conducted during the month of January, 1981, which was approximately two months after the end of 1980 cropping year and also a slack period for the farmers. A total of fifty farms were surveyed following the eight questionnaire test farm cases. The smallest farm surveyed was 1.25 feddans and the largest 11.5 feddans.

SECTION II

CROP ENTERPRISE BUDGETS

INTRODUCTION

Crop enterprise budget is a systematic collection of relevant costs and returns associated with a specific crop or livestock. An individual farm may consist of several crop and livestock enterprises Each enterprise has a defined set of inputs, production techniques, and measurable output or services. The crop enterprises can be distinguished by their end products such as cotton, rice, and wheat.

The budget for a particular crop represents a single point on th production function (Osburn and Schneeberger, 1978). The term produc tion function refers to the physical relationships between the input of resources and the output of goods and services per unit of time. By increasing or decreasing the quantities of resource inputs, the level of output can be increased or decreased.

The costs and returns presented in a budget are based on a certain level of fertilizer application, type of seed, tillage practice, and others. Where there are major differences in these variables across the farms, several budgets for a specific crop which incorpora tes these differences may need to be constructed. Since the level of application of different inputs, production techniques, and prices change through time, the crop enterprise budgets will have to be continuously revised.

A crop enterprise budget consists of three major parts. The first part includes the volume of the main output such as ardabs of wheat grain, the by-product such as camel loads of wheat straw per unit of land, and their prices. Values of various output items in this section are summed up to present the gross return from the specific crop enterprise.

The second part of the budget accounts for the expenses incurred from use of various inputs which changes with the level of production. The variable cost items can be classified into groups in order to meet specific analytical objectives. When cash expenses become a critical factor in production, then the inputs and operations which require cash payments can be grouped in one section. Likewise, labor utilization and costs, irrigation expenses, and harvesting costs can be brought together to form subsections within the variable costs category.

The third part of the budget is made up of fixed costs. Fixed costs include the expenses which do not vary with the level of production such as the opportunity cost of land and land tax. Expenses which apply to the entire farming operation such as management, interest, and depreciation on machinery are also included in this section. In order to determine the real profitability of different enterprises the fixed costs must be allocated to different enterprises on a consistent and equitable basis. Otherwise the result from the enterprise analysis may also be distorted.

The quantity and timing of use of resources of irrigation water and farm labor by various crop enterprises may be critical in production of crops where the supply of these two resources cannot meet the demand during certain stages of production. Inclusion of a monthly water and labor use schedule as part of budget further adds to the value of budgets as planning tool (see Appendix C).

CROP ENTERPRISE BUDGETS -- CONSTRUCTION PROCEDURE

The rationale used in constructing the crop enterprise budgets will illustrate the farming system of the study area and facilitate revision of the budgets as the production practices, level of inputs, utilization, and price change. The crop enterprise budgets are based on an average sample survey farm size of 4.9 feddans in Abu Raya, Kafr El-Sheikh. The survey data was supplemented with EWUP farm records, EWUP Water Lifting Cost Study (Walters, 1980) and information gathered from Abu Raya cooperative in building the crop enterprise budgets.

For better illustration, the crop enterprise budgets will be disaggregated into crop production and value, purchased inputs, land preparation, labor utilization, animal utilization, and fixed costs. The procedure utilized in determining the quantities and prices for various costs and return items, classified under the aforementioned categories, will be described.

Crop Output and Value

This section accounts for various crops and crop residue output per feddan and their prices. The output data are presented in the unit of measure commonly used by the farmers in the area.

The output per feddan of various crops and crop residues is an average of actual yield achieved by the surveyed farmers. This, however, does not apply to the case of sugar beets which is a newly introduced crop in the area. The sugar beet yield is based on a single farm case study.

Prices for governmental crops of cotton, sugar beets, and for 50 percent of rice output, which are sold to the government, are based on the average prices that were paid by the cooperative to the farmers. Prices for other crops and crop residues are based on average market prices quoted by farmers for 1980 (Table 1).

Yield data for broad beans, maize, and wheat which are primarily produced for farm household consumption are based on 15, 38, and 46 surveyed farms respectively. The average yield per feddan for broad beans was 3.9, for maize 9.4 and for wheat 7.7 ardabs. Broad beans and wheat crops also produce straw which is used as animal feed during the summer season and consequently make significant contribution to the value of these two crops. Maize straw is mostly used as fuel by the farmers (Appendix B.3, B.6, and B.9).

Flax is a dual purpose cash crop produced for fiber and oil. It was produced by 19 farmers or 38 percent of all the farms surveyed in Abu Raya. One feddan of flax crop on the average produced 0.6 ton of seed and 2.1 tons of straw which were entirely sold to the market (Appendix B.5).

Table 1. Average Output per Feddan and Prices per Unit for Major Crops and Crop Residues, Abu Raya, Kafr El-Sheikh, 1980.

Crops and Crop Residues	Unit	Output per Feddan	Price per Unit
CROPS:			
Berseem - Long-term	kerat cut	53.40	2.00
Short-term	kerat cut	26.00	2.00
Broad Beans	ardab	3.90	34.42
Cotton	kentar	5.20	49.30
Flax	ton	0.60	272.40
Maize	ardab	9.40	16.60
Rice	ton	1.80	80.00[1]
Sugar Beets	ton	22.00	11.40
Wheat	ardab	7.70	11.06
CROP RESIDUES:			
Berseem - Seed	kaila	8.00	5.00
- Straw	camel load	4.00	1.75
Broad Beans Straw	camel load	5.00	10.00
Flax Straw	camel load	2.10	16.60
Cotton Stock	camel load	3.60	3.10
Maize Stock	camel load	5.60	1.30
Rice Straw	camel load	3.50	1.40
Wheat Straw	camel load	5.00	9.60

Source: EWUP Farm Management Survey, EWUP Farm Records, Abu Raya Cooperative.

[1]Fifty percent of rice was sold to government at 75 L.E. per ton. Market price for rice was 85 L.E. per ton in 1980.

Cotton and rice are governmental crops, the area and field location of which are determined by the cooperative. Cotton was produced by 86 percent of the farmers and the average cotton yield per feddan was 5.2 kentars. Rice was produced by 94 percent of the farmers and had resulted in an average output of 1.8 tons per feddan in Abu Raya in 1980 (Appendix B.4 and B.7).

Long-term berseem on the average gives four cuttings, except when one cutting is reserved for seed. Sixty-seven percent of the berseem producers that were surveyed had attained four cuttings while the remaining 33 percent obtained three cuts. The net crop area per feddan is 20 kerats when the area occupied by irrigation and drainage ditches, and roads are subtracted.

In the berseem crop enterprise budget the last cut is considered for seed and hay and the remaining 2.7 cuts or 54 kerat cuts are fed to livestock as green forage (Appendix B.2). The weight of one cutting of berseem clover varies from 5-8 tons per feddan depending on soil fertility and age of cutting, the average being 6.5 tons per feddan (El Tobgy, 1976).

Short-term berseem produces one to two cuttings. In order not to delay planting of cotton one cutting is recommended. Survey data indicates 70 percent of the farmers as having obtained 2 cuttings and the remaining 30 percent one cutting from their short-term berseem crop. A weighted average of cuttings and 20 kerat net crop area resulted in an average of 26 kerat cuts for the surveyed farmers in Abu Raya in 1980 (Appendix B.2).

The cotton prices paid by government in 1980 ranged from 42.9 L.E. to 50.7 L.E. per kentar depending on quality and degree of cleanliness. The average price for the cotton submitted to cooperative by the farmers in Abu Raya was estimated at 49.20 L.E. per kentar. A cost of 0.68 L.E. per kentar for marketing, andweighting and taxes of 1.12 L.E. per kentar for stadium, hospital and university was deducted from the price of cotton paid to the farmers. Including these deductions the net price received by farmers was 47.40 L.E. per kentar in 1980. In the cotton enterprise budget the marketing and weighing charges are treated as an expense item (Abu Raya Cooperative).

Most of the rice produced in Abu Raya was of the Japanese variety. Price paid by government for this rice variety with 96 percent purity was 75 L.E. per metric ton. This price was discounted by 0.78 L.E. for each percent decline in purity up to 92 percent purity level and the discount factor was doubled for purity level below 92 percent. The rice sold to the Abu Raya cooperative mostly fell in the 92 to 98 percent purity range with over 50 percent of rice with purity of over 96 percent.

A marketing and weighing expense of 0.68 L.E. per ton and taxes of 0.87 L.E. per ton for the stadium, hospital, and university was discounted from the price paid to the farmers per ton of rice. In the rice enterprise budget a price of 75 L.E. per ton was used for 50 percent of the output which was sold to the cooperative and the deductions for marketing and weighing was treated as an expense item.

With the exception of flax, the major portion of the output of all non-governmental crops was consumed on the farm as food, animal feed, and fuel. However, the market value for these crops and crop residues was known to the surveyed farmers due to actual market transactions by them and their awareness of the market prices. The average prices used for non-governmental crops are based on the prices quoted by the surveyed farmers.

Purchased Inputs

This section includes seed and chemical fertilizers applied per feddan of a specific crop in the surveyed farms. The seed for government crops of cotton and sugar beets used by all the farmers and of rice used by 77 percent of the farmers was purchased from the cooperative. Fifty-eight percent of the farmers that produced wheat and 8 percent of the farmers that produced maize also purchased the seeds for these two crops from the cooperative. The balance of the farmers that produced rice, wheat, and maize and all the seeds for the flax and berseem crops were either purchased from the market and other farmers or came from their own farms (Table 2).

The seeds obtained from the market and the farms were valued at the market price received by the farmers. Since the market selling prices are higher than the prices received by the farmers, this would underestimate the market prices for the portion of flax, maize, and wheat seeds purchased from the market. The seed prices used in the budget are a weighted average of government and market prices (Table 3).

Table 2. Source of Seed for Major Crops, Abu Raya, Kafr El-Sheikh, 1980.

Crops	Sources				
	Cooperative	Market	Own Farm	Other Farms	Total
		percent			
Berseem	0	34	64	0	100
Cotton	100	0	0	0	100
Flax	0	50	36	14	100
Maize	8	13	61	18	100
Rice	77	0	17	6	100
Sugar Beets	100	0	0	0	100
Wheat	58	8	32	2	100

Source: EWUP Farm Management Survey.

Individual crop budgets indicate the varieties of nitrogen and phosphorus fertilizer used by the farmers (Appendix A). The volume of different fertilizers used for various crops is calculated as a simple arithmetic mean of the per feddan fertilizer application rate by the farmers producing those crops. The small application rate values such as seven kilograms of ammonium sulfate per feddan of maize and five kilograms of ammonium nitrate per feddan of rice indicates their use by a small group of farmers.

Over 70 percent of all fertilizers used were purchased from the cooperative and the balance from the market. The market price for fertilizers is generally about twice the government price. The fertilizer prices used in the budget are weighted averages of government and market prices (Table 4).

Table 3. Seeding Rate and Price of Seed per Unit, Abu Raya, Kafr El-Sheikh, 1980.

Crops	Unit	Seed Applied per Feddan	Price per Unit	
			Government	Market
			----L.E.----	
Berseem	Kaila	1.60	---	5.000
Broad Beans	Kaila	6.00	2.033	2.870
Cotton	Kaila	6.74	0.273	---
Flax	Kg	67.91	---	0.272
Maize	Kaila	2.30	1.810	1.383
Rice	Kaila	5.95	1.140	0.850
Sugar Beets	Kg	7.00	2.000	---
Wheat	Kaila	6.13	0.888	0.925

Source: EWUP Farm Management Survey, Abu Raya Cooperative.

Table 4. Sources and Prices of Fertilizers Purchased, Abu Raya, Kafr El-Sheikh, 1980.

Fertilizer Type	Sources		Prices per Kg		
	Market	Government	Market	Government	Average
	------Percent------		---L.E.---		
Ammonium Sulfate 20.6	10.2	89.8	0.08	0.044	0.048
Ammonium Nitrate 33.5	21.8	78.2	0.10	0.067	0.077
Ammonium Nitrate 31.5	22.6	77.4	0.13	0.062	0.074
Urea 46	23.7	76.3	0.16	0.092	0.108
Super Phosphate 15.5	26.8	73.2	0.09	0.030	0.046
Super Trible 42.0	17.2	82.8	0.12	0.082	0.089

Source: EWUP Farm Management Survey, Abu Raya Cooperative.

Land Preparation

Land preparation activities and costs vary from crop to crop. Cotton, sugar beets, and broad beans require three to four plowings, smoothing, and furrowing while berseem requires only one plowing when it follows cotton and corn and generally no plowing when it follows rice. Land is generally plowed twice for wheat, flax, rice, and corn.

Tractor was used for plowing by all farms and for smoothing and furrowing by 75 percent of the farms. Twenty-one percent of the farmers had relied entirely on animal power for smoothing and furrowing while the remaining 4 percent used both tractor and animal. Due to small and declining use of animal in land preparation and the difficulty of estimating its cost, all the land preparation activities in the crop enterprise budgets were estimated on the basis of tractor rental cost.

The average time required per feddan for various land preparation activities as reported by the farmers were 1.77 hours for one plowing, 3.13 hours for two-way plowing, and 4.23 hours for a three-way plowing. Smoothing and furrowing activities took less than one hour per feddan. Based on the cost paid for different number of plowings and time required for each plowing the average cost of tractor in plowing was about 1.7 L.E. per hour (Table 5a).

Table 5a. Land Preparation Activities by Tractor, Hours, and Cost per Feddan, Abu Raya, Kafr El-Sheikh, 1980.

Activities	Hours per Feddan	Cost per Feddan
	-----Hours------	------L.E.-----
One Plowing	1.77	3.03
Two Plowings	3.13	5.39
Three Plowings	4.23	7.25
Smoothing	0.96	2.20
Furrowing	0.85	1.83

Source: EWUP Farm Management Survey.

Labor Utilization

Labor makes up a major part of the variable costs from seeding to harvesting. Labor cost ranged from 59 percent of the variable cost of cotton crop to 37 percent of the variable cost of wheat crop. The highest per feddan labor cost was 101 L.E. which occurred in production of cotton. Sugar beet was the second highest labor use crop with a total labor cost of 62.19 L.E. per feddan, followed by rice with a total labor cost of 58.10 L.E. or 53 percent of total variable cost of rice production. These estimates do not include the labor share of the cost of tractor operation and labor that operated camels and donkeys in transport of inputs and products.

Labor use occurs throughout the crop season and consists of different types (men, women, and children) of labor. A number of operations for each crop enterprise is carried out entirely by specific

type of labor such as application of water and hoeing by men, while most other operations use men, women, and children. Where an operation is commonly carried out by a specific type of labor, in the crop enterprise budget that operation is assigned to that type of labor and the corresponding wage rate is imputed. This labor cost estimation procedure was applied to the cases of weeding and operation of saqia which were identified as boys' and girls' task and planting of rice seedlings which was classified as women's task in the budgets.

An equal participation from two or all three types of labor were assumed for the operations that could not clearly be assigned to a specific type of labor. The wage rate used in this case was an average of the wages paid for the combination of labor considered. This procedure was applied to the cases of wheat harvesting which was classified as a joint men and women task and the planting of cotton seed which was classified as a women and children task. (For monthly crop labor utilization by type of labor, see Appendix C.)

The irrigation labor time for berseem, cotton, flax, rice, and wheat are based on actual measurements of water application and the saqia discharge rate by three to five farmers for each crop. An average discharge rate of 113 cubic meters per hour was used for estimating hours of irrigation from the volume of water applied. Irrigation time for other crops are based on farm records. The labor times for application of water for berseem and rice were estimated as 50 percent of the irrigation time. This is due to wide basin irrigation system of these two crops which allows the farmers to engage in other farming activities during the irrigation.

The average wage rate was estimated at 1.8 L.E. per day for men, 1.2 L.E. per day for women, and 0.90 L.E. per day for boys and girls. The average work days is considered to be six hours. The actual hours worked per day and the wages paid vary by the type of operation and time of the year. Daily wages also vary throughout the season due to labor demand and supply situation.

Threshing operations for rice and wheat crops are done with threshing machine, and the payment for the use of machine and labor operating it is jointly made on an hourly basis. In the cases of other crops requiring labor in threshing operation the labor cost is estimated as a separate cost item.

Winnowing of berseem seed, broad beans, rice, and wheat are done as custom operation and the compensation for this task is made by payment in kind. The established rates for wheat and berseem seed were one kaila per ardab and for rice and broad beans half a kaila per ardab of grain processed. The monetary cost of the grain given out as payment for winnowing was imputed on the basis of the market price of grain.

Animal Utilization

Ninety-four percent of the farmers surveyed owned a buffalo or cow or both. On the average each farmer owned one buffalo, one cow, and one donkey. Cows and buffalo were used by 25 percent of the surveyed farmers in land preparation and by about 90 percent of the farmers as source of power for lifting water. Buffalo and cows are

also used as source of milk for the farm family and as a means of accumulation of wealth.

Since the buffalo and cows used in turning the saqia are owned, no cash outlays are made by the farmers and consequently this cost is not directly perceived by them. Seventy percent of the farmers that were surveyed indicated that even if they switched from saqia to a diesel or electric pump for lifting water they were going to maintain more than half (3 out of 4, or all) of their existing livestock number.

In estimating the cost of lifting water an average of 0.08 L.E. per hour was assigned for use of buffalo and cows. This estimate is based on incremental cost of higher feed requirement, loss of milk, and lower calving rate that results from use of buffalo and cows in turning the saqia (Walters, 1980).

Donkeys and camels are used in transport of various inputs to the field and outputs from the field to the village and to the market. Donkeys and camels attributed to the cost of crop production in transport of manure to the field and of crop and crop residue from the field to the village respectively. The cost for these two activities were assigned on the basis of established rate in the area.

Fixed Costs

This section of the budget accounts for the opportunity cost of land and management, investment in saqia and land tax.

The cost of saqia consisted of interest on investment, depreciation, and maintenance. These cost items were estimated to be 81.80 L.E. per year for a saqia serving an area of 10 feddans. Based on the

cropping mix in the survey area and the hours of saqia operations per feddan of each crop an hourly cost of 0.11 L.E. per hour of saqia operation was estimated. This method of allocating the fixed cost of saqia results in higher cost for higher water consuming crops of rice and berseem and a lower cost for low water consuming crops of wheat and flax.

Ninety-eight percent of the farms surveyed and 90 percent of the survey area were owner-operated. Since the opportunity for renting out the land on a crop share or cash rent basis is readily available to these farmers, then the income foregone from renting out the land needs to be treated as a cost associated with the crop in production of which the land is allocated.

The average rent paid in the survey area was 72 L.E. per feddan per year. This is equivalent to the rate that can be charged using government rent formula which determines the rent ceiling as seven times the land tax. The assessed land tax in AbuRaya was 10 L.E. per feddan per year in 1980. Due to double cropping and differences in the length of timein which the land is occupied by different crops, the land cost and land tax were assessed on a monthly basis.

In an attempt to account for all explicit and implicit costs associated with production of a particular crop a management charge of 1.0 L.E. per month was assigned. Management charge represents the opportunity cost of the time and effort spent by the farmers in obtaining inputs from the cooperative and market, marketing of products, and planning for the overall farm and individual crop enterprises.

SECTION III

PROFITABILITY ANALYSIS

Net Income Analysis

Net income or return above all costs to farmer as presented in Table 5 is an estimate of profitability of major crops per feddan where all cash and non-cash expenses to the farmer is considered. This includes an opportunity cost for family labor, land, and management.

Sugar beets, a winter crop which was introduced to this area in 1980 following the construction of a sugar beet factory in Kafr El-Sheikh, has resulted in a net income of 78.28 L.E. per feddan. This makes sugar beets the most profitable crop in this area. The amount of land in this crop is expected to increase in the coming years as the sugar beet factory tries to attain optimal capacity operation. The area allocated to sugar beets is determined by the cooperative and a set price is offered to the sugar beet producers by the sugar beet company. The high sugar beet profitability may be necessary if the land is to be diverted away from berseem and subsistence crops of wheat. Sugar beets also have the highest return above variable costs (Table 5b).

Flax, also a winter crop with the net income of 61.46 L.E., was the second most profitable crop. The profitability position of this market cash crop had not changed when the fixed cost was considered. The return above variable costs for flax was 111.24 L.E. which was the

Table 5b. Returns and Costs per Feddan of Major Crops, Abu Raya, Egypt, 1980.

Crops	Gross[a] Income	Variable[b] Costs	Return Above Variable Costs	Rank	Fixed Costs	Net Income	Rank
L. T. Berseem	155.00	77.79	77.21	6	61.08	16.13	6
S. T. Berseem	52.00	28.32	23.68	9	25.03	(1.35)	8
Broad Beans	184.16	91.70	92.46	4	49.29	43.17	3
Cotton	267.00	173.13	93.87	3	76.08	17.79	5
Flax	198.06	86.82	111.24	2	49.79	61.46	2
Maize	173.95	95.60	78.25	5	42.23	36.12	4
Rice	148.90	108.65	40.25	8	53.38	(13.13)	9
Sugar Beets	250.80	130.40	120.40	1	42.12	78.28	1
Wheat	133.47	77.91	55.56	7	49.18	6.38	7

Source: Computed

[a]Total value of both primary and secondary products at prices received by farmers.

[b]Include purchased inputs and services, family labor, and animal power costs.

second highest. Based on net income profitability criteria the third position was held by broad beans which is also a winter crop.

Cotton, a summer crop, had resulted in the third highest return above variable costs. Since cotton occupies the land for a period of nine months and consequently is assigned a higher cost for land and taxes in the fixed cost category, its profitability rank based on net income falls to the fifth position.

Rice which occupies more than half of the summer land area generated returns above variable costs of 40.25 L.E. and when the fixed costs were subtracted, it resulted in a net loss of 12.64 L.E. per feddan. The discrepancy between the high summer area and the low profitability of rice is due to the fact that rice is a governmental crop, the production area and the price of which is determined by the Egyptian government.

Based on net income analysis sugar beets are the most profitable winter crop and maize the most profitable summer crop. Since these two crops can follow each other in rotation then the highest net income per year (114.40 L.E.) from a parcel of land was obtained from production of sugar beets in the winter and maize in the summer. A feddan of land that was used for production of flax in the winter and maize in the summer had generated a net income of 97.58 L.E. which was the second highest net income per year (Table 6).

Survey data indicates that only 8 percent of winter land was allocated to flax and 11 percent of summer land to maize. These two crops can be viewed as occupying the residual land area. Maize is

produced in the portion of summer land area which is not designated for cotton and rice and flax is produced on the portion of land area which has remained following the allocation of winter land to berseem for livestock feed and wheat and broad beans for farm household consumption.

Table 6. Five Most Profitable Crop Rotations Based on Net Income, Abu Raya, Egypt, 1980.

Crop Rotation	Net Income per Feddan per Year	Rank
Sugar beets - maize[a]	114.40	1
Flax - maize	97.58	2
Broad beans - maize	79.29	3
Sugar beets - rice	65.15	4
S. T. berseem - cotton	61.46	5

Source: Computed

[a]Sugar beets were produced only on the 100 feddans or 3 percent of total farm area in the Abu Raya Cooperative District in 1980.

Thirty percent of the winter land was allocated to the production of short-term berseem which is determined by the governmental crops of cotton which can be proceeded in rotation only by short-term berseem. Long-term berseem was produced on 23 percent of the winter land area and the entire berseem output of each of the 50 farms surveyed was utilized for feeding its livestock. Wheat occupied 26 percent of the winter land area and only 8 percent of the total wheat grain output

was marketed. Broad beans were produced on 4 percent of the winter land area and 22 percent of total broad beans output was marketed.

The use of net income as profitability criteria assumed that the farmers impute an opportunity cost for their land and family labor and are also considering the cost of animal for lifting water and the depreciation from the saqia.

Where off-farm employment is not readily available and the land owners do not engage in employment as a common farm laborers,the net cash inflow per feddan of a particular crop may become an appropriate criteria for determining the profitability of crops from the point of view of the farmers. In this context the next section will explore the profitability of these crops on the basis of their gross margins.

Gross Margin Analysis

Gross margin represent the cash income or its equivalent in commodities that the farmers received per feddan from his crop after payments for all current expenses incurred in production of the crop was made. The current expenses consist of payments for purchased inputs of fertilizer and seed, and payments for services such as tractor rental charges and wages for hired labor.

Sugar beets resulted in a gross margin of 144.75 L.E. per feddan or 28.95 L.E. per feddan month (Table 7). In either case it ranked as the most profitable winter crop.[2] When sugar beets were not considered, flax with gross margin of 123.16 L.E. per feddan will be the most

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[2] Sugar beets were recently introduced in Abu Raya farming area and the sugar beet enterprise budget is based on a single case study farm, thereby it should be assessed with great caution in this profitability analysis.

profitable crop followed closely by maize as the second most profitable crop. This profitability ranking between flax and maize is reversed when they are compared on the basis of gross margin per month. This is due to the fact that flax crop occupies the land for six months while maize is produced over a five-month period. Rice and short-term berseem continue to maintain the position of the least two profitable crops as they did under net income profitability criteria.

The five most profitable rotations and their ranking under gross margin analysis remains the same as it was estimated by net income analysis. This occurred in spite of the significant differences in cost of family labor for these crops (Table 8).

Excluding sugar beets, the three most profitable rotations in 1980 crop year were flax - maize, broad beans - maize, and short-term berseem -cotton in that order. As stated earlier, this profitability ranking does not correspond to the actual cropping pattern in 1980. Neither can this be used as a determinant of the future cropping pattern until economic, social, and institutional constraints are considered.

Table 7. Gross Margins per Feddan, Major Crops, Abu Raya, Egypt, 1980.

Crops	Gross Income	Variable[a] Cash Costs	Gross Margin	Rank	Crop Duration (month)	Gross Margin per month	Rank
L. T. Berseem	155.00	49.83	105.17	6	7	15.02	5
S. T. Berseem	52.00	20.00	32.00	9	3	10.67	8
Broad Beans	184.16	74.67	112.49	4	6	18.75	4
Cotton	267.00	157.68	109.32	5	9	12.15	6
Flax	198.06	74.90	123.16	2	6	20.53	3
Maize	173.95	51.76	122.19	3	5	24.44	2
Rice	148.90	94.09	54.81	8	6	9.14	9
Sugar Beets	250.80	106.05	144.75	1	5	28.95	1
Wheat	133.47	66.21	67.26	7	6	11.21	7

Source: Computed

[a]Excludes family labor, animal power, and fixed costs.

Table 8. Five Most Profitable Crop Rotations Based on Gross Margins, Abu Raya, Egypt, 1980.

Crop Rotation	Gross Margin per Feddan per Year	Rank
	------L.E.------	
Sugar beets - maize	266.94	1
Flax - maize	245.35	2
Broad bean - maize	234.68	3
Sugar beets - rice	199.56	4
S. T. berseem - cotton	141.32	5

Source: Computed

When return to one factor such as land, water, and labor is the concern,the costs associated with all other inputs will be subtracted from the gross income. Since different crops occupy the land for varied length of time and farm land is a limited resource,the return to land per month may become a desirable criteria for comparing the profitability of different crops. Likewise,when water is viewed as a scarce resource,the return per unit of water applied in different crops may become an appropriate measure of crop profitability. Similar rationale can be applied to labor and such other inputs. In this report only the return to water will be examined.

Return to Water

The variable and fixed costs as estimated in Table 5 account for all the cash and non-cash costs attributable to the farmers in the production of various crops. Since the water is provided to the farmers free of charge, the residual or net income can be used as a measure of estimating return per cubic meter of water applied. It should be acknowledged that this estimation of return to water does not represent the value of water in production of these crops. This is due to differences that exist between the prices of inputs and products used in the budget and their prices under free market conditions. Considering the return to water for various crops and the volume of water required by them, sugar beets generate the highest return (0.03 L.E.) per cubic meter of water applied, followed by broad beans and flax in second position with a return of 0.02 L.E. per cubic meter (Table 9).

Table 9. Net Return per Cubic Meter of Water Applied, Abu Raya, Egypt, 1980.

Crops	Net Income	Water Applied	Return per Cubic Meter	Rank
		(m^3)		
L. T. Berseem	16.13	6,441	0.0025	7
S. T. Berseem	(1.35)	1,622		
Broad beans	43.17	2,373	0.02	2
Cotton	17.79	5,763	0.003	4
Flax	61.46	2,878	0.02	2
Maize	36.12	3,164	0.01	3
Rice	(12.64)	6,594		
Sugar beets	78.28	3,051	0.03	1
Wheat	6.38	2,233	0.0029	5

Berseem, cotton, and wheat resulted in a return of two to three millimes per cubic meter of water while short-term berseem and rice made no compensation to the cost of water utilized by them. The cost of water is estimated by one source as two millimes for every cubic meter of water delivered to the field (Waterbury, 1979).

Consideration of available agricultural resources of land, irrigation water, farm labor and fertilizers; farm livestock feed and farm household food requirements; and the government policies regarding the allocation of land area to the production of cotton, rice, sugar beets, and their prices require a rather complex budgeting technique. Linear programming model will be utilized to determine the optimal crop mix and rotation under existing government policies and price-cost structure as well as under free market conditions.

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APPENDIX A

CONVERSION FACTORS AND ABBREVIATIONS

CONVERSION FACTORS

Area		Sq. Meter		Acre		Feddan		Hectare
1 feddan (fed)	=	4,200.8335	=	1.03805	=	1	=	0.42008
1 acre	=	4,046.856	=	1	=	0.96335	=	0.40469
1 hectare (ha)	=	10,000	=	2.47105	=	2.38048	=	1
1 sq kilometer	=	100×10^4	=	247.105	=	238.048	=	100
1 sq mile	=	259×10^6	=	640	=	616.4	=	259

Water Use:

1 billion m^3 = 810,710 acre-feet
1,000m^3 = 0.81071 acre-foot = 9.72852 acre-inch
1,000 m^3/feddan = 238 mm of rainfall

Commodity Measurements:

	Egyptian Unit	Weight in kg	Weight in lbs
Cotton (unginned)	Metric kantar	157.5	346.92
Cotton (lint or ginned)	Metric kantar	50.0	110.13
Rice (rough or unmilled)	Dariba	945.0	2081.50
Berseem Clover	Ardab	157.0	345.81
Broadbeans	Ardab	155.0	341.41
Wheat	Ardab	150.0	330.40
Maize	Ardab	140.0	308.37
Flaxon Linseed	Ardab	122.0	268.72
Cottonseed	Ardab	120.0	264.32
Berseem Seed	Ardab	157.0	345.00
Rice, Flax and Wheat Straw	Camel load	225.0	495.00
Stover, Stems	Camel load	250.0	550.00

Others:

1 feddan = 24 kerats
1 ardab = 12 kaila
1 ardab = 198 liters = 5.62 bushels (U.S.)
1 kg/feddan = 2.12 lb/acre
1 ardab/feddan = 5.41 bushels/acre

ABBREVIATIONS

App. - Application

B. - Boy

C.L. - Camel Load

D.L. - Donkey Load

Fert. - Fertilizer

G. - Girl

L.T. - Long Term

N. - Nitrogen

P. - Phosphorus

S.T. - Short Term

W. - Women

APPENDIX B

CROP ENTERPRISE BUDGETS

TABLE B. 1.

COST AND RETURN PER FEDDAN OF L. T. BERSEEM PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Berseem Clover	Kerat Cut	54.00	2.000	108.00
Berseem Seed	Kaila	8.00	5.000	40.00
Berseem Straw	C.L.	4.00	1.750	7.00
Total Income				155.00
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila	1.60	5.000	8.00
Ammonium Nitrate, 33.5% N	Kg	5.00	0.074	0.37
Urea, 46.0% N	Kg	7.00	0.108	0.76
Super Phosphate, 15.5% P	Kg	12.00	0.046	0.55
Super Treble, 42 % P	Kg	9.00	0.089	0.80
Production Practices:				
Plowing	Feddan	1.00	3.000	3.00
Seeding	Man Hr.	2.00	0.300	0.60
Chemical Fert. App.	Man Hr.	1.00	0.300	0.30
Irrigation				
Water Lifting	Cow Hr.	57.00	0.080	4.56
	B&G Hr.	57.00	0.150	8.55
Water Application	Man Hr.	28.50	0.300	8.55
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting[a]	Man Hr.	74.00	0.300	22.20
Threshing	Tractor Hr.	2.00	3.000	6.00
	Man Hr.	6.00	0.300	1.80
Winnowing[b]	Kaila	0.67	5.000	3.35

Table B. 1. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading	Man Hr.	6.00	0.300	1.80
Transporting	C. L.	6.00	0.500	3.00
Total Variable Costs				77.79
Return Over Variable Costs				77.21
FIXED COSTS				
Saqia	Hour	57.00	0.110	6.27
Land Rent	Month	7.00	6.000	42.00
Land Tax	Month	7.00	0.830	5.81
Management Charge	Month	7.00	1.000	7.00
Total Fixed Costs				61.08
Grand Total Costs				138.87
Return Above All Costs				16.13

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

[a]Labor requirement is estimated on the basis of cutting one kerat area of berseem per hour.

[b]Paid in kind at the rate of one kaila per ardab of berseem seed processed.

TABLE B. 2.

COST AND RETURN PER FEDDAN OF S.T. BERSEEM PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Berseem Clover	Kerat Cut	26.00	2.000	52.00
Total Income				52.00
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila	1.60	5.000	8.00
Production Practices:				
Plowing	Feddan	1.00	3.000	3.00
Seeding	Man Hr.	2.00	0.300	0.60
Irrigation:				
Water Lifting	Cow Hr.	14.00	0.080	1.12
	B&G Hrs.	14.00	0.150	2.10
Water Application	Man Hr.	7.00	0.300	2.10
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting	Man Hr.	26.00	0.300	7.80
Total Variable Costs				28.32
Return Over Variable Costs				23.68
FIXED COSTS				
Saqia	Hour	14.00	0.110	1.54
Land Rent	Month	3.00	6.000	18.00
Land Tax	Month	3.00	0.830	2.49
Management charge	Month	3.00	1.000	3.00
Total Fixed Costs				25.03
Grand Total Costs				53.35
Return Above All Costs				(1.35)

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

TABLE B. 3.

COST AND RETURN PER FEDDAN OF BROAD BEANS PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Broad Beans Grain	Ardab	3.90	34.400	134.16
Broad Beans Straw	C.L.	5.00	10.000	50.00
Total Income				184.16
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila	6.00	2.870	17.22
Super Phosphate, 15.5% P	Kg	7.00	0.046	0.32
Production Practices:				
Plowing	Feddan	1.00	5.400	5.40
Smoothing	Feddan	1.00	2.200	2.20
Furrowing	Feddan	1.00	1.800	1.80
Seeding	Woman Hr.	19.00	0.200	3.80
Weeding	B&G Hr.	60.00	0.150	9.00
Chemical Fert. App.	Man Hr.	1.00	0.300	0.30
Irrigation				
Water Lifting	Cow Hr.	21.00	0.080	1.68
	B&G Hr.	21.00	0.150	3.15
Water Application	Man Hr.	21.00	0.300	6.30
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting	Man Hr.	40.00	0.300	12.00
Threshing	Mach. Hr.	3.00	3.000	9.00
	Man Hr.	18.00	0.300	5.40
Winnowing[a]	Kaila	2.00	2.870	5.73

Table B. 3. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading	Man Hr	6.00	0.300	1.80
Transporting	C. L.	6.00	0.500	3.00
Total Variable Costs				91.70
Return Over Variable Costs				92.46
FIXED COSTS				
Saqia	Hour	21.00	0.110	2.31
Land Rent	Month	6.00	6.000	36.00
Land Tax	Month	6.00	0.830	4.98
Management Charge	Month	6.00	1.000	6.00
Total Fixed Costs				49.29
Grand Total Costs				140.99
Return Above All Costs				43.17

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

[a]Paid in kind at the rate of half kaila per ardab of broad beans processed.

TABLE B. 4.

COST AND RETURN PER FEDDAN OF COTTON PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Unginned Cotton	Kentar	5.20	49.200	255.84
Cotton Stalks	C.L.	3.60	3.100	11.16
Total Income				267.00
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila	6.70	0.270	1.81
Ammonium Nitrate, 31.5% N	Kg	17.00	0.077	1.31
Ammonium Nitrate, 33.5% N	Kg	82.00	0.074	6.07
Urea, 46.0% N	Kg	34.00	0.108	3.67
Super Phosphate, 15.5% P	Kg	16.00	0.046	0.74
Super Triple, 42 % P	Kg	28.00	0.089	2.49
Production Practices:				
Plowing	Feddan	1.00	7.250	7.25
Smoothing	Feddan	1.00	2.200	2.20
Furrowing	Feddan	1.00	1.800	1.80
Seeding	W,B&G Hr.	19.00	0.180	3.42
Hoeing	Man Hr.	24.00	0.300	7.20
Weeding	B&G Hr.	24.00	0.150	3.60
Thinning	B&G Hr.	18.00	0.150	2.70
Chemical Fert. App.	Man Hr.	10.00	0.300	3.00
Organic Fert. Transport	D.L.	100.00	0.050	5.00
Organic Fert. App.	Man Hr.	4.00	0.300	1.20
Picking Insect Eggs	Feddan	1.00	9.000	9.00
Spraying Insecticide	Feddan	1.00	20.000	20.00
Irrigation				
Water Lifting[a]	Cow Hr.	51.00	0.080	4.08
	B&G Hr.	51.00	0.150	7.65
Water Application	Man Hr.	51.00	0.300	15.30
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Picking-2 times	W,B&G Hr.	240.00	0.180	43.20
Cutting Stalks	Man Hr.	30.00	0.300	9.00

Table B. 4. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading Stalks	Man Hr.	5.00	0.300	1.50
Transporting Stalks	C.L.	3.60	0.500	1.80
Transporting Unginned Cotton	Feddan	1.00	1.000	1.00
Taxes, Marketing, and Weighing	Kentar	5.20	0.680	3.54
Total Variable Costs				173.13
Return Over Variable Costs				93.87
FIXED COSTS				
Saqia	Hour	51.00	0.110	5.61
Land Rent	Month	9.00	6.000	54.00
Land Tax	Month	9.00	0.830	7.47
Management Charge	Month	9.00	1.000	9.00
Total Fixed Costs				76.08
Grand Total Costs				249.21
Return Above All Costs				17.79

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

[a] Includes thirteen hours of irrigation in October for pulling the cotton stock.

TABLE B. 5.

COST AND RETURN PER FEDDAN OF FLAX PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Flax Seed	Ton	0.60	272.000	163.20
Flax Straw	Ton	2.10	16.600	34.86
Total Income				198.06
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kg	52.60	0.270	14.20
Ammonium Nitrate, 33.5% N	Kg	77.0	0.074	5.70
Urea, 46.0% N	Kg	12.00	0.108	1.30
Production Practices:				
Plowing	Feddan	1.00	5.400	5.40
Smoothing	Feddan	1.00	2.200	2.20
Seeding	Man Hr.	1.00	0.300	0.30
Weeding	B&G Hr.	60.00	0.150	9.00
Chemical Fert. App.	Man Hr.	3.00	0.300	0.90
Irrigation				
Water Lifting	Cow Hr.	25.50	0.080	2.04
	B&G Hr.	25.50	0.150	3.83
Water Application	Man Hr.	25.50	0.300	7.65
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting	Man Hr.	50.00	0.300	15.00
Threshing	Tractor Hr.	0.30	2.000	0.60
Winnowing	Man Hr.	9.00	0.300	2.70
Sheafing the Plants	B&G Hr.	30.00	0.150	4.50
Ropes for Sheafing	Kg.	6.00	0.250	1.50

Table B. 5. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading	Man Hr.	8.00	0.300	2.40
Transporting	C.L.	8.00	0.500	4.00
Total Variable Costs				86.82
Return Over Variable Costs				111.24
FIXED COSTS				
Saqia	Hour	25.50	0.110	2.81
Land Rent	Month	6.00	6.000	36.00
Land Tax	Month	6.00	0.830	4.98
Management Charge	Month	6.00	1.000	6.00
Total Fixed Costs				49.79
Grand Total Costs				136.61
Return Above All Costs				61.45

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

TABLE B. 6.

COST AND RETURN PER FEDDAN OF MAIZE PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Maize Grain	Ardab	9.40	16.600	156.04
Maize Straw	C.L.	5.60	1.300	7.28
Maize Cobs	Kg	345.00	0.025	8.63
Maize Strippings	Kg	200.00	0.010	2.00
Total Income				173.95
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila	2.30	1.410	3.24
Ammonium Sulfate, 20.6% N	Kg	7.00	0.048	0.34
Ammonium Nitrate, 31.5% N	Kg	13.00	0.077	1.00
Ammonium Nitrate, 33.5% N	Kg	80.00	0.074	5.92
Urea, 46.0% N	Kg	53.00	0.108	5.72
Super Phosphate 15.5% P	Kg	14.00	0.046	0.64
Production Practices:				
Plowing	Feddan	1.00	5.400	5.40
Smoothing	Feddan	1.00	2.200	2.20
Furrowing	Feddan	1.00	1.800	1.80
Seeding	Woman Hr.	18.00	0.200	3.60
Weeding	B&G Hr.	18.00	0.150	2.70
Chemical Fert. App.	Man Hr.	6.00	0.300	1.80
Organic Fert. App.	Man Hr.	8.00	0.300	2.40
Organic Fert. Transport	D.L.	200.00	0.05	10.00
Irrigation				
Water Lifting	Cow Hr.	28.00	0.080	2.24
	B&G Hr.	28.00	0.150	4.20
Water Application	Man Hr.	28.00	0.300	8.40
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting	Man Hr.	24.00	0.300	7.20
Pulling Cobs/Tying Straw	Woman Hr.	30.00	0.200	6.00
Threshing	Woman Hr.	48.00	0.200	9.60

Table B. 6. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading	Man Hr.	7.00	0.300	2.10
Transporting	C. L.	7.00	0.500	3.50
Transporting Cobs	Donkey Hr.	7.00	0.300	2.10
Total Variable Costs				95.70
Return Over Variable Costs				78.25
FIXED COSTS				
Saqia	Hour	28.00	0.110	3.08
Land Rent	Month	5.00	6.000	30.00
Land Tax	Month	5.00	0.830	4.15
Management Charge	Month	5.00	1.000	5.00
Total Fixed Costs				42.23
Grand Total Costs				137.93
Return Above All Costs				36.02

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

TABLE B. 7.

COST AND RETURN PER FEDDAN OF RICE PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Rice Grain Sold to Government	Kg	900.00	0.075	67.50
Rice Grain Consumed/Marketed	Kg	900.00	0.085	76.50
Rice Straw	C.L.	3.50	1.400	4.90
Total Income				148.90
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila[a]	6.00	1.080	6.48
Ammonium Sulfate, 20.6% N	Kg	141.00	0.048	6.77
Ammonium Nitrate, 33.5% N	Kg	5.00	0.074	0.37
Urea, 46.0% N	Kg	12.00	0.108	1.30
Super Triple, 42 % P	Kg	14.00	0.089	1.25
Production Practices:				
Plowing	Feddan	1.00	5.400	5.40
Seeding	Man Hr.	1.00	0.300	0.30
Rice Puddling	Man Hr.	3.00	0.300	0.90
	Cow Hr.	3.00	0.080	0.24
Transplanting				
Pull and Transport	Man Hr.	20.00	0.300	6.00
Planting	Woman Hr.	40.00	0.200	8.00
Weeding	B&G Hr.	24.00	0.150	3.60
Chemical Fert. App.	Man Hr.	6.00	0.300	1.80
Organic Fert. Transport	D.L.	50.00	0.050	2.50
Organic Fert. App.	Man Hr.	2.00	0.300	0.60
Irrigation				
Water Lifting	Cow Hr.	58.00	0.080	4.64
	B&G Hr.	58.00	0.150	8.70
Water Application	Man Hr.	29.00	0.300	8.70
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting	Man Hr.	35.00	0.300	10.50
Threshing	Mach. Hr.	3.00	3.000	9.00

Table B. 7. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Winnowing[b]	Kaila	7.50	0.850	6.38
Bundling	Man Hr.	8.00	0.300	2.40
Loading	Man Hr.	10.00	0.300	3.00
Transporting	C. L.	10.00	0.500	5.00
Taxes, Marketing and Weighing	Ton	1.80	0.68	1.22
Total Variable Costs				108.65
Return Over Variable Costs				40.25
FIXED COSTS				
Saqia	Hour	58.00	0.110	6.38
Land Rent	Month	6.00	6.000	36.00
Land Tax	Month	6.00	0.830	5.00
Management	Month	6.00	1.000	6.00
Total Fixed Costs				53.38
Grand Total Costs				162.03
Return Above All Costs				(13.13)

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

[a]One Kaila of rice is equal to ten kilograms.

[b]Paid in kind at the rate of half kaila per ardab which is equivalent to 5 kilograms for every 120 kilogramsof rice processed.

TABLE B. 8.

COST AND RETURN PER FEDDAN OF SUGAR BEETS PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Sugar Beets	Ton	22.0	11.400	250.80
Total Income				250.80
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kg	7.00	2.000	14.00
Ammonium Nitrate, 33.5% N	Kg	200.00	0.074	14.80
Insecticide	Kg	2.00	11.500	23.00
Production Practices:				
Plowing	Feddan	1.00	7.250	7.25
Smoothing	Feddan	1.00	2.200	2.20
Furrowing	Feddan	1.00	1.800	1.80
Seeding	W,B&G Hr.	18.00	0.180	3.24
Hoeing	Man Hr.	35.00	0.300	10.50
Weeding	B&G Hr.	72.00	0.150	10.80
Thinning	B&G Hr.	18.00	0.150	2.70
Chemical Fert. App.	Man Hr.	12.00	0.300	3.60
Insecticide Application	Man Hr.	6.00	0.300	1.80
Irrigation				
Water Lifting	Cow Hr.	27.00	0.080	2.16
	B&G Hr.	27.00	0.150	4.05
Water Application	Man Hr.	27.00	0.300	8.10
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Plow with Tractor	Feddan	1.00	3.000	3.00
Harvesting	W,B&G Hr.	50.00	0.180	9.00

Table B. 8. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading	Woman Hr.	24.00	0.200	4.80
Total Variable Costs				130.40
Return Over Variable Costs				120.40
FIXED COSTS				
Saqia	Hour	27.00	0.110	2.97
Land Rent	Month	5.00	6.000	30.00
Land Tax	Month	5.00	0.830	4.15
Management Charge	Month	5.00	1.000	5.00
Total Fixed Costs				42.12
Grand Total Costs				172.52
Return Above All Costs				78.28

Source: EWUP Farm Record, Staff paper No. 21, and Abu Raya Cooperative.

TABLE B. 9.

COST AND RETURN PER FEDDAN OF WHEAT PRODUCTION, ABU RAYA 1980

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
INCOME				
Wheat Grain	Ardab	7.70	11.100	85.47
Wheat Straw	C.L.	5.00	9.600	48.00
Total Income				133.47
VARIABLE COSTS				
Purchased Inputs:				
Seed	Kaila	6.10	0.910	5.55
Ammonium Nitrate, 33.5% N	Kg	60.00	0.074	4.44
Urea, 46.0% N	Kg	33.00	0.108	3.56
Super Phosphate, 15.5% P	Kg	5.00	0.046	0.23
Super Triple, 42.0% P	Kg	8.00	0.089	0.71
Production Practices:				
Plowing	Feddan	1.00	5.400	5.40
Smoothing	Feddan	1.00	2.200	2.20
Seeding	Man Hr.	3.00	0.300	0.90
Weeding	B&G Hr.	12.00	0.150	1.80
Organic Fert. Transport	D.L.	100.00	0.050	5.00
Chemical Fert. App.	Man Hr.	4.00	0.300	1.20
Organic Fert. App.	Man Hr.	4.00	0.300	1.20
Irrigation				
Water Lifting	Cow Hr.	20.00	0.080	1.60
	B&G Hr.	20.00	0.150	3.00
Water Application	Man Hr.	20.00	0.300	6.00
Ditch Maintenance	Man Hr.	12.00	0.300	3.60
Harvesting and Transportation:				
Harvesting	M&W Hr.	36.00	0.250	9.00
Threshing[a]	Mach. Hr.	3.00	3.000	9.00
Winnowing[a]	Kaila	7.70	0.930	7.12

Table B. 9. (Continued)

Item	Unit	Number of Units	Price or Cost/Unit	Total Income or Cost
Loading	Man Hr.	8.00	0.300	2.40
Transporting	C. L.	8.00	0.500	4.00
Total Variable Costs				77.91
Return Over Variable Costs				55.56
FIXED COSTS				
Saqia	Hour	20.00	0.110	2.20
Land Rent	Month	6.00	6.000	36.00
Land Tax	Month	6.00	0.830	4.98
Management Charge	Month	6.00	1.000	6.00
Total Fixed Costs				49.18
Grand Total Costs				127.09
Return Above All Costs				6.38

Source: EWUP Farm Management Survey, Farm Records, Staff paper No. 21, and Abu Raya Cooperative.

[a]Paid in kind at the rate of one kaila per ardab of wheat processed.

APPENDIX C

MONTHLY LABOR AND WATER UTILIZATION

TABLE C. 1.

Monthly Labor and Water Requirements
Per Feddan of L.T. BERSEEM, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
November	18		7	811
December				
January	19		7	811
February	20		10	1,071
March	21		12	1,378
April	25		21	2,373
May	15			
June	12			
Season	130		57	6,444

Source: EWUP Farm Management Survey, Farm Records, and Engineering Survey.

TABLE C. 2.

Monthly Labor and Water Requirements
Per Feddan of S.T. BERSEEM, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
November	18		7	811
December				
January	16		7	811
February	13			
Season	47		14	1,622

Source: EWUP Farm Management Survey, Farm Records, and Engineering Survey.

TABLE C. 3.

Monthly Labor and Water Requirements
Per Feddan of BROAD BEANS, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
November	18	19	6	678
December	6		45	565
January			20	
February	5		5	565
March	5		5	565
April	58			
May	6			
Season	98	19	81	2,373

Source: EWUP Farm Management Survey, and Farm Records.

TABLE C. 4.

Monthly Labor and Water Requirements
Per Feddan of COTTON, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
February	16	10	9	
March	20		40	1,082
April	5		17	515
May	16		4	417
June	5		5	620
July	22		10	1,151
August	4		4	508
September		60	60	
October	48	60	73	1,470[a]
Season	136	130	222	5,763

Source: EWUP Farm Management Survey, Farm Records, and Engineering Survey.

[a]Post harvest irrigation is generally carried out in order to soften the ground for pulling the cotton stalk.

TABLE C. 5.

Monthly Labor and Water Requirements
Per Feddan of FLAX, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
November	19		6	651
December	3		33	294
January	7		34	431
February	7		7	809
March	6		6	693
April	67		30	
Season	109		116	2,878

Source: EWUP Farm Management Survey, Farm Records, and Engineering Survey.

TABLE C. 6.

Monthly Labor and Water Requirements
Per Fddan of MAIZE, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
May	24	18	4	452
June	8		16	904
July	11		13	904
August	11		13	904
September	31	78	7	
Season	85	96	53	3,164

Source: EWUP Farm Management Survey, and Farm Records.

TABLE C. 7.

Monthly Labor and Water Requirements
Per Feddan of RICE, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
May	21		18	732[a]
June	42	40	31	2,188[b]
July	22		16	1,762
August	12		12	1,378
September	5		5	534
October	53			
Season	155	40	82	6,594

Source: EWUP Farm Management Survey, Farm Records, and Engineering Survey.

[a]Water applied in the rice nursery.

[b]Includes the irrigation for rice transplanting.

TABLE C. 8.

Monthly Labor and Water Requirements
Per Feddan of SUGAR BEETS, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
November	21	9	18	1,017
December	37		36	678
January	7		30	
February	21		36	678
March	6	49	31	678
Season	92	58	151	3,051

Source: EWUP Farm Records.

TABLE C. 9.

Monthly Labor and Water Requirements
Per Feddan of WHEAT, Abu Raya, 1980

Month	Labor Requirements			Water Requirements
	Man	Woman	Boy/Girl	M^3
November	22		3	410
December	3		3	334
January	2		14	205
February	11		7	755
March	5		5	529
April				
May	26	18		
Season	69	18	32	2,233

Source: EWUP Farm Management Survey, Farm Records, and Engineering Survey.

APPENDIX D

FARM MANAGEMENT
SURVEY QUESTIONNAIRE

Farmer's Name _____

Location Along the Mesqa _____

A. Land Resource, Value and Rental Cost

1. Land farmed with relatives . . . . _____
2. Land farmed by immediate family . _____
3. Land owned by immediate family . . _____
4. Number of fragmented parcels owned _____
5. Land rented in . . . . . _____
6. Land rented out . . . . . _____

If land rented in, then:

1. Cash rent paid per feddan _____
2. Crop share

	Name	Share
a. Crop 1	_____	_____
b. Crop 2	_____	_____
c. Crop 3	_____	_____

3. Duration of rent
   a. one season _____
   b. one year _____
   c. more than one year _____

If land rented out, then:

1. Cash rent received per feddan _____
2. Crop share

	Name	Share
a. Crop 1	_____	_____

b. Crop 2 _____ _____

c. Crop 3 _____ _____

3. Duration of rent

a. one season _____

b. one year _____

c. more than one year _____

B. Crops Grown, Area, Rotation, and Disposition

1. Winter crops (Winter 1979-80)

		Wheat	Flax	Short Berseem	Long Berseem	Others
a.	feddan & kerats	F K	F K	F K	F K	F K
b.	unit of measure					
c.	output total area					
d.	wages quantity					
e.	government quantity					
f.	government price					
g.	household quantity					
h.	market quantity					
i.	market price					
j.	expected yield per feddan					
k.	highest per feddan yield obtained by farmers in this area					
l.	lowest per feddan yield obtained by farmers in this area					
m.	previous crop					

2. Summer crops (1980)

		Cotton	Rice	Maize	Others
a.	feddans kerats	F K	F K	F K	F K
b.	unit of measure				
c.	output total area				
d.	wages quantity				
e.	government quantity				
f.	government price				
g.	household quantity				
h.	market quantity				
i.	market price				
j.	expected yield per feddan				
k.	highest per feddan yield obtained by farmers in this area				
l.	lowest per feddan yield obtained by farmers in this area				

3. Winter crops (1980-81)

		Wheat	Flax	Short Berseem	Long Berseem	Others
a.	feddans & kerats	F K	F K	F K	F K	F K
b.	expected yield per feddan					

C. Animal Species Owned, Marketing Practice, and Value

			Buffalo	Cattle	Sheep	Goats	Donkey	Camel
1.	a.	number owned						
	b.	age						

	c.	sex	___	___	___	___			
	d.	market value	___	___	___	___	Total	Total	Total
2.	a.	number purchased last 12 months	___	___	___	___	___	___	___
	b.	age	___	___	___	___	___	___	___
	c.	sex	___	___	___	___	___	___	___
	d.	market*	___	___	___	___	___	___	___
	e.	price paid	___	___	___	___	___	___	___
3.	a.	number sold last 12 months	___	___	___	___	___	___	___
	b.	age	___	___	___	___	___	___	___
	c.	sex	___	___	___	___	___	___	___
	d.	market*	___	___	___	___	___	___	___
	e.	price received	___	___	___	___	___	___	___
4.		Slaughtered for household consumption	___	___	___	___	___	___	___

D. Disposal of Crop Residue and Animal By-Products

		Unit	Output From Area	Use A Use No.**	Use A Portion	Use B Use No.**	Use B Portion	Price/ Unit
1.	corn stalks	___	___	___	___	___	___	___
2.	corn leaves & tassles	___	___	___	___	___	___	___
3.	cotton stalks	___	___	___	___	___	___	___
4.	wheat straw	___	___	___	___	___	___	___
5.	flax straw	___	___	___	___	___	___	___
6.	rice straw	___	___	___	___	___	___	___

7.	manure all livestock	____	_____	___	____	___	____	_____
8.	buffalo milk per year per buffalo	____	_____	___	____	___	____	_____
9.	cow milk per year per cow	____	_____	___	____	___	____	_____

* Market: 1- local farmer; 2- farmer another village; 3- middleman; 4- government agency; 5- village auction; 6- local butcher

** Uses: 1- fertilizer; 2- fuel; 3- animal feed; 4- consumed as food; 5- sold to market; 6- sold to other farmers

E. Water Availability Along the Mesqa

1. How frequently do you receive adequate water for your crops in the two cropping seasons?

	Summer	Winter
Always	_____	_____
Usually	_____	_____
Frequently	_____	_____
Rarely	_____	_____

2. Month at which water was not adequate _____

3. If irrigated at night, will you be able to obtain adequate water:

	Summer	Winter
Always	_____	_____
Usually	_____	_____
Frequently	_____	_____
Rarely	_____	_____

F. Water Lifting Practices

1. Water is presently lifted from the canal (or mesqa) by:

Tambour _____

Saqia _____

Pump _____

Diesel _____

Electric _____

2. If by saqia:

Number of farmers that share the saqia _____

Number of feddans served by the saqia _____

3. If by pump, do you:

a. own _____

purchase cost _____

year purchased _____

fuel cost (annual) _____

maintenance expense (annual) _____

labor cost (annual) _____

b. rent _____

rate per hour _____ or per feddan _____

rent in summer _____

rent in winter _____

G. Sources and Costs of Fertilizer, Pesticide and Animal Feed

	Volume Market	Price/ 50 kg Sack	Volume Governorate	Price/ 50 kg Sack
1. Fertilizer				
a. _____	_____	_____	_____	_____

b. _____ _____ _____ _____ _____

c. _____ _____ _____ _____ _____

d. _____ _____ _____ _____ _____

e. _____ _____ _____ _____ _____

2. Pesticide

a. _____ _____ _____ _____ _____

b. _____ _____ _____ _____ _____

c. _____ _____ _____ _____ _____

3. Cotton Seed Cake _____ _____ _____ _____

4. Wheat Bran _____ _____ _____ _____

5. Others _____ _____ _____ _____

H. Seeding Rate and Application of Fertilizer and Insecticides for Area of Individual Crops

	Unit	Cotton	Rice	Maize	Berseem	Wheat	Flax	Other
1. Seed Applied								
2. Source of Seed*								
3. Ammonium Nitrate (33.5-0.0)								
4. Ammonium Nitrate (31.5-0.0)								
5. Super Phosphate								
6. Urea								
7. Ammonium Sulfate								
8. Super Triple Phosphate								

I. Use of Machine and Animal in Several Farming Operations

		Machine			Animal
		Machine	Cost Per Feddan	Source**	
1.	one plowing	hrs/fed			hrs/fed
2.	two plowing	hrs/fed			hrs/fed
3.	three plowing	hrs/fed			hrs/fed
4.	furrowing	hrs/fed			hrs/fed
5.	smoothing	hrs/fed			hrs/fed
6.	rice puddling	hrs/fed			hrs/fed

* Source: 1- Cooperative
2- Market
3- Other farmers
4- His own farm

** Source: 1- Cooperative
2- Tractor owner
3- Other private tractor owners

J. Labor Utilization and Hiring Practices for Major Crops

Crop _____ Area _____ Total _____

	Days required by activity	Number of labor used: Family	Number of labor used: Hired	Hours worked per day	Type of labor*	Wages paid per worker per day
1. Plowing						
2. Furrowing						
3. Smoothing						
4. Seeding						
5. Weeding						
6. Spraying chemicals						
7. Spreading manure						
8. Applying chemical fertilizer						
9. Transplanting rice						
10. Picking cotton						
#1						
#2						
#3						
11. Harvesting						
12. Chopping or pulling stock						
13. Thrashing						
14. Winnowing						
15. Irrigation						

* Type of labor: 1- man 2- woman 3-boys and girls

K. Family Labor Force

		Age	Off Farm Employment			Work Other Farms	
			Days/year	Wage/day	Month worked	Number of Days/year	Type of Payment*
1. Adults:	Name _____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
2. Boys & Girls: (8 year old or more)	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
3. Number of children less than 8 years old	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____
4. Number of children attending school	_____	___	_____	_____	_____	_____	_____
	_____	___	_____	_____	_____	_____	_____

* Payment: 1- cash 2- goods 3- reciprocated with labor 4- reciprocated with animal

L.

	Yes	No
1. Would you like to produce forage instead of some cash crop in the summer?	___	___

2. If you could replace sakia with a pump, how many of existing buffalo and cows would you still keep?

   All _____ 3/4 _____ 1/2 _____ 1/4 _____

3. a. If possible, would you like to have more of the land preparation done by tractors at the rate charged by private tractor owners?

   Yes _____ No _____

   b. If yes, how many of buffalo and cows would you still keep?

   All _____ 3/4 _____ 1/2 _____ 1/4 _____

4. Animal most preferred: _____

5. Animal most profitable: _____

6. Most important reason for keeping buffalo and cows*: _____

7. Crop most profitable: _____

8. What are your views about the following?

   a. Adequacy of fertilizer, tractors and other inputs and services provided by the government:

   _____

   _____

   _____

   b. Crop rotation and limitations imposed in production of different crops:

   _____

   _____

   _____

* Reasons: a- land preparation
b- lifting water
c- product milk and meat for household consumption
d- raising for selling

AMERICAN EQUIVALENTS OF EGYPTIAN ARABIC
TERMS AND MEASURES COMMONLY USED
IN IRRIGATION WORK

Land Area	in *sq meters*	in *acres*	in *feddans*	in *hectares*
1 acre	4,046.856	1	0.96335	0.40469
1 *feddan*	4,200.8335	1.03805	1	0.42008
1 hectare(ha)	10,000.00	2.47105	2.38048	1
1 *sq* kilometer	100×10^4	247.105	238,048	100.00
1 *sq* mile	259×10^6	640.00	616.4	259.00

Water Measures

1 billion m^3 = 810,710 acre-feet
1000 m^3 = 0.81071 acre-foot = 9.72852 acre-inch
1000 m^3/*feddan* = 0.781 acre-foot/acre = 9.372 acre-inch/acre
(= 238 mm of rainfall)

Other Conversions

1 *ardeb* = 198 liters = 5.62 bushels (U.S)
1 *ardeb/feddan* = 5.41 bushels/acre
1 kg/*feddan* = 2.12 lb/acre
1 donkey load = 100 kg
1 camel load = 250 kg
1 donkey load of manure = 0.1 m^3
1 camel load of manure = 0.25 m^3

Egyptian Unit for Field Crops

Crop	Eg. Unit	in kg	in lbs	in bushels
Lentils	*ardeb*	160.0	352.42	5.87
Clover	*ardeb*	157.0	345.81	5.76
Broad beans	*ardeb*	155.0	341.41	6.10
Wheat	*ardeb*	150.0	330.40	5.51
Maize, Sorghum	*ardeb*	140.0	308.37	5.51
Barley	*ardeb*	120.0	264.32	5.51
Cottonseed	*ardeb*	120.0	264.32	8.26
Sesame	*ardeb*	120.0	264.32	
Groundnut	*ardeb*	75.0	165.20	7.51
Rice	*dariba*	945.0	2081.50	46.26
Chick-peas	*ardeb*	150.0	330.40	
Lupine	*ardeb*	150.0	330.40	
Linseed	*ardeb*	122.0	268.72	
Fenugreek	*ardeb*	155.0	341.41	
Cotton(unginned)	*metric qintar*	157.5	346.92	
Cotton(lint or ginned)	*metric qintar*	50.0	110.13	

Egyptian Farming and Irrigation Terms

fani[1] = branch
marwa = small distributer, irrigation ditch
masraf = field drain
mesqa = small canal feeding from 10 to 40 farms
qirat = cf. English "karat," A land measure of 1/24 *feddan*, 175.03 m^2
qaria = village
sahm = 1/24th of a *qirat*, 7.29 m^2
saqia = animal powered water wheel
sarf = drain (vb.), or drainage. See also *masraf*, (n.)