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TECHNICAL REPORT NO. 30

THE ROLE OF FARM RECORDS IN THE EGYPT WATER USE AND MANAGEMENT PROJECT

by

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EGYPT WATER USE AND MANAGEMENT PROJECT

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ABSTRACT

The Egypt Water Use and Management Project functions in an interdisciplinary mode to formulate, demonstrate and evaluate on-farm management alternatives. An assessment of the economic and social benefits attributable to these alternatives is necessary to meet the project goals. A farm record system was developed to provide the basis for economic analysis needed for monitoring and planning. Water application data when included in enterprise cost studies allows for estimates of returns to water. Use of farm record data in conjunction with water budget data lend insight into water scheduling.

21 pages 3 figures 4 tables

مستخلـــــــص

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يعمل مشروع تطوير استخدام مياه الرى فى مصر بنظام الفريق الواحد ذو التخصصات المختلفة متعاونة فيما بينها لوضع وتقييم بدائل استخدام المياه على مستوى المزرعة . وكذا دراسة الفوائد الاجتماعية والاقتصادية المصاحبة لهذة البدائل وايهما يتمشى مع الأهداف التى يرمى اليهـــــا المشـــروع .

ولقد صممت السجلات المزرعية بحيث توفر المعلومات الأساسية اللازمة للقيام بالتحليلات الاقتصادية التى تلزمنا للتخطيط الصحيح . كما أنـــه عندما تتضمن دراسة التكاليف والعائد للمحاصيل بيانات عن كميات ميـــاه الرى المستخدمة فهذا يتيح تقدير العائد الى مياه الرى .

ان استخدام البيانات المتوفرة فى السجلات المزرعية مع بيانـــــات ميزانية مياه الرى فهذايساعد فى وضع وتصميم جدوله لمياه الرى .

٢١ صفحـــة ٣ اشكـــال ٢ جداول

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1. INTRODUCTION *

The Egypt Water Use and Management Project is structured to function in an interdisciplinary mode to formulate and demonstrate viable on-farm management alternatives for the typical Egyptian farmer. Although water use and management is emphasized in the project title, it was realized from the inception of the project that the interaction of water with all other resources used in a modern irrigated agricultural system must be considered if the proposed innovations were to be acceptable and of lasting benefit. Of primary concern is the allocation of water, soil, capital and human resources used in agricultural production to allow for significant economic and social progress for the Egyptian farmers.

The farm enterprise system is not only governed by climate and soil, but also by the input of water, fertilizer, labor and associated technological input available from farm research. Modern technology may offer solutions to identified constraints or problems. It is the purpose of an interdisciplinary team of trained experts to determine which and what combinations of modern technology should be directed into the hands of the farmer. Without a thorough understanding of the problem, technology transfer will not be possible. Technicians often recognize that farmers need only to see the differences in methods or procedures correlated with the increased benefits related to the technology to accept it. However, on-farm demonstrations often do not illustrate these increased benefits or identify a technology that is not of practical value to a farmer.

The purpose of this paper is to present the methodology utilized for assessing on-farm water management alternatives. The presentation will be somewhat skewed toward the data collection process undertaken to bolster the economic analysis. Finally, some preliminary results will be presented, drawing not only on the economic data but also on the data collected by the engineers, agronomists and sociologists.

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* Paper presented at the International Workshop on Water Resources Planning, Alexandria, Egypt, A.R.E., September 20-22, 1982.

2. BACKGROUND

The Egypt Water Use and Management Project was effectively divided into two stages; first, the problem identification stage and second, the pilot program implementation stage. Currently, the Egypt Water Use and Management Project is in the pilot program implementation stage.

2.1 Problem Identification Stage

The first stage, or the period of problem identification, initialized the data collection process in the project as engineers, agronomists, economists and sociologists went to the field to collect the data required for quantifying hypothesized problems or problem areas. The solutions to the problems or problem areas were used as the basis for formulating on-farm management alternatives.

During this period, the engineers conducted on-farm water management surveys where a complete water budget was obtained for selected fields. Water budget surveys for the areas were initiated for determining surface flows, ground water flows, and drainage in each of the areas.

The agronomists made field observations on plant growth characteristics, soil characteristics, agronomic management and irrigation practices. Additional data were collected to quantify the soil-plant-water system in each of the areas. A soil and land classification survey was conducted at the sites to determine structure, consistency, color, mottling depth and water table location. An analysis was made on the soil profiles for exchange capacity, exchangeable sodium and water soluble salts, pH, gypsum requirements, soil organic matter, soil fertility, lime requirements and for determining a moisture curve.

The economists analyzed the data collected from several farms at each site to assess the financial status of the farmers in the area. Enterprise cost studies were developed from the data for the crops produced in the area.

Evaluations were also made of the costs of lifting water by alternative methods.

The sociologists conducted surveys to obtain data on crop production, ownership, and population characteristics in each area. Data were also collected on urban encroachment on agricultural lands, joint-family operations, decision making, rural out-migration, and socio-economic consequences of mechanization that appear relevant to meeting project objectives.

Each discipline had its own set of criteria for site selection, including soil characteristics, size of farm, location of the mesqa, and the operator's personal characteristics. Since the Egypt Water Use and Management Project had been developed as an interdisciplinary activity, it was necessary to assess the project's long range data requirements. This concluded with a limited number of common case study farm sites selected in each area and delineation of the data requirements for meeting the project's goals.

2.2 Systems Modelling

Systems modelling efforts can help to direct and structure data collection activities within an interdisciplinary framework, since they identify specific data requirements for the evaluation of alternative objectives being considered. In the Egypt Water Use and Management Project the modelling effort evolved in the form of several simulation models, each with its own data requirements and specific objectives. The overall thrust of this modelling effort, Figure 1, was to link these sub-models to form a simulation model for evaluating water management alternatives.

The data requirements for operating such a model are immense. A partial list of the data requirements by major area follows:

2.2.1 Soil Properties

1. Measures of water holding capacity for soil layers where the water table does not preclude root development to these depths.
2. Infiltration constants.
3. Values of the roughness coefficient for different cropping conditions.

2.2.2 Weather Data

1. Daily maximum and minimum temperatures.
2. Daily pan evaporation.
3. Daily wind velocity.
4. Daily maximum and minimum relative humidity.
5. Daily precipitation.

2.2.3 Crop Data

1. Specifications of the length of each of the developmental stages for crops grown in Egypt.
2. Specification of the number and length of physiological growth stages for crops grown in Egypt.

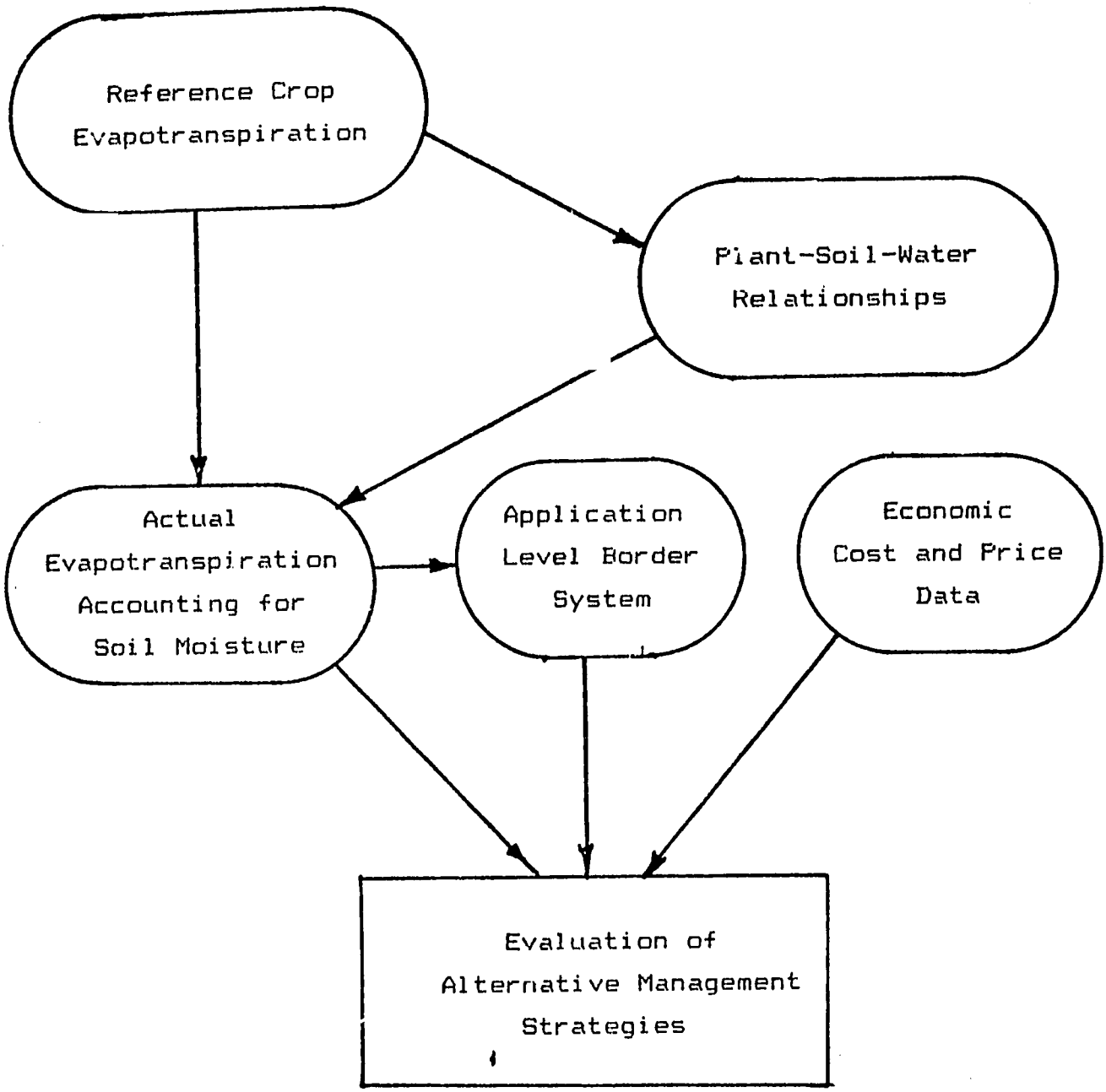

Figure 1. Structure of the Model Used for Evaluating Alternative Management Strategies.

3. Maximum rooting depths and the number of days required by the plants roots to reach that depth for crops grown in Egypt.

2.2.4 Soil-Plant-Water Relationships

1. For a given crop, measurements of soil moisture prior to each irrigation for each of the soil layers identified in the section on soil properties.
2. Daily water table levels.

2.2.5 Yield Response to Water Data

1. Planting date, harvest date, and dates of transition between physiological growth stages.
2. Dates and amounts of water applied for each irrigation for specified crops.
3. Crop Yields, dry matter (forage) as well as grain.

2.2.6 Water Application

1. Typical height of lift with some measure of variability.
2. Flow rates attainable with alternative lifting devices.
3. Flow rates attainable in the gravity systems in operation.
4. Conveyance losses.
5. Field application efficiencies.

2.2.7 Cost and Price Information

1. Fixed and variable costs associated with alternative lifting devices.
2. Enterprise budgets for crops grown in Egypt.

Computer programs were developed and tested for the simulation models. However, there has been limited use of these models due to complexity of the data requirements and the resource availability for constantly updating such a data set. Initially to test the models, data were defined for only one crop and water application system in a given area.

3. THE EGYPT WATER USE AND MANAGEMENT PROJECT FARM RECORD SYSTEM

The improvement of the economic and social well-being of Egyptian farmers through improvements in on-farm water management is a primary objective of the Egypt Water Use and Management Project. To accomplish this goal a measure of economic and social well-being is required. A farm record system provides a

good measure of the economic status of farmers. As on-farm water management is improved, the economic impacts of these improvements should be reflected through the record system. Some impacts can be observed immediately, others may have to be observed over a number of years.

The Egypt Water Use and Management Project farm records are used to evaluate the relative contributions of alternative enterprises to farm income, to delineate the production activities for each enterprise, to determine the factors which limit operating decisions, and to enable comparisons with other farmers following similar practices. Effective implementation of the record system necessitated that project personnel become intimately acquainted with the complexities of the farming system in Egypt.

Unfortunately, record systems and efficiency ratios developed for commercial farming systems in developed countries and used for comparative analysis are of limited applicability for farming systems found in developing countries. Further, most developed country farm record systems are designed to be kept by farmers for their own management use. The Egypt Water Use and Management Project record system must provide reliable data to evaluate the feasibility of introduced technologies and the impacts of the technologies on enterprise returns, farm income and farm resource use. To serve the analytical needs for the agricultural system of the developing country, the concepts of comparative analysis are revised and uniquely adapted to describe the system.

3.1 Procedure

The Egypt Water Use and Management Project operates at three sites in three governorates, Abyuha in El Minya, Mansuriya in Giza, and Abu-Raya in Kafr el Sheikh. At each of the three project sites, farms were selected for intensive study by the economics team. Farm selections were based on location with respect to source of water, conditions of water delivery, irrigation system and method, soil types, shape and level of fields, crops produced, ownership and other social aspects.

A farm record was to be kept on each of these selected farms. Currently farm records are being kept on 15 farms at the Abyuha site, 27 farms at the Mansuriya site, and 22 farms at the Abu Raya site.

3.2 Farm Record Design

Egypt's complex farming system necessitated designing a simple farm record book which could provide the information needed for future planning. Therefore, the major emphasis in the design of the farm record was on simplicity. The objective for having the record system is to measure the

economic and financial success and progress of the farmer over time, to determine the constraints under which the farmer operates, to determine the more profitable enterprises, and to aid the Ministry of Irrigation in planning for the future.

3.3 Implementation

The farm record system was implemented at the Mansuriya and Abu Raya sites during the 1978 - 1979 crop year and at the Abuyha site during the 1979 - 1980 crop year. The farm record year, November 1 to October 31, was chosen to coincide as nearly as possible with the crop year.

A limited number of farmers were selected initially at each site. These numbers were expanded to the present level during the 1980 - 1981 farm record period.

Since most cooperating farmers are illiterate, the study case farmers are visited at least once every two weeks by the Egypt Water Use and Management Project economists to accurately record the data. The records are summarized by the site economists at the end of the farm record period.

4. PRELIMINARY RESULTS

4.1 Farm Record Summaries

At the end of each farm record period each farm record is summarized as presented in Table 1. This summary, which is divided into six sections, condenses the farmer's activities for the previous farm record year. The farmer's asset position is presented in Inventory Changes section. The farmer's production for the farm record year is presented in Animal and Crop Production section. The cash expenses associated with the various crops produced during the farm record year are presented in Crop Expenses section. Other cash expenses are presented in Non-Crop Expenses section. A measure of the farmers well-being, net farm income, is presented following the Summary of Income and Summary of Expense section. Finally, a measure of the productive output of animals owned by the farmer is presented in Work Done by Animals section.

The summaries of the farm records provide a basis for comparative analysis. Efficiency ratios permit a number of comparisons. The relative contribution of crops versus livestock, including the value of work done by livestock, to gross and net farm income is one such comparison. Gross returns per unit of expense measures income efficiency as do income per unit of cropland and income per farm member.

TABLE 1.

FARM RECORD SUMMARY

Summarized by: Nabil Kamal Farag
Agricultural Year November 1, 1980 to October 31, 1981
Farmer's #: 14
Location: ABUEHA MINYA GOVERNORATE

Reviewed by: Farouk Abdel Al EWUP Economics Team

Family members: Male: 8 Female: 4 Total: 12
Farm size feddans: 5.33
Owned : 0.00 Rented: 5.33 Shared: 0.00

INVENTORY CHANGES

	Item	Beginning LE	End LE	Change LE	Remarks
1	Inventory of Equipment	35.0	40.0	5.0	
2	Inventory of Livestock	1800.0	1865.0	65.0	
3	Inventory of Poultry	85.0	50.0	-35.0	
4	Inventory of Grain and Forage	427.5	327.0	-100.5	
5	Inventory of Land and Real Estate	0.0	0.0	0.0	
Total		2347.5	2202.0	- 65.5	

ANIMAL AND CROP PRODUCTION

Animal Products				Crop Products				
Home Use LE	Sales LE	Other LE	Total LE	Animal Feed LE	Home Use LE	Seed LE	Sales LE	Total LE
329.0	0.0	0.0	329.0	934.5	255.5	64.0	1507.0	2761.0

CROP EXPENSES

	Crop	Field Number	Crop Code	Area Feddan	Labor LE	Equipment LE	Organic Fert.LE	Chemical Fert. LE	Seed LE	Pesticide LE	Other LE	Total LE
1	Broadbeans	1	3	0.58	18.4	3.0	0.0	0.0	0.0	0.0	0.0	21.4
2	Berseem	2	1	1.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	Wheat	3	2	1.71	49.0	18.0	0.0	9.5	0.0	0.0	0.0	76.5
4	Berseem	4	1	0.63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Broadbeans	5	3	0.54	13.4	3.5	0.0	0.0	0.0	0.0	0.0	16.9
6	Berseem	6	1	0.71	8.0	4.5	0.0	6.1	0.0	0.0	0.0	18.6
7	Cotton	1	6	0.58	36.8	0.0	0.0	13.8	0.8	16.5	0.0	67.9
8	Cotton	2	6	1.17	44.5	10.5	0.0	12.6	1.8	33.0	0.0	102.4
9	Maize	3	8	1.17	45.0	3.0	0.0	30.8	0.0	0.0	0.0	86.8
10	Cotton	4	6	0.63	28.8	6.0	0.0	9.5	0.9	17.5	0.0	62.7
11	Cotton	5	6	0.54	20.9	0.0	0.0	7.8	0.8	15.5	0.0	45.0
12	Maize	6	8	0.71	13.0	0.0	0.0	18.0	0.0	0.0	0.0	31.0
Total LE				10.14	277.8	48.5	0.0	116.1	4.3	82.5	0.0	529.2

NON-CROP EXPENSES

	Kind of Expenses	LE		Kind of Expenses	LE
1	Purchased Animal Feed	194.3	6		0.0
2	Land Rent	320.0	7		0.0
3	Taxes	0.0	8		0.0
4	Share Rent	0.0	9		0.0
5		0.0	10		0.0
Total Non-Crop Expense					514.3

Summary of Income		Summary of Expenses	
Animal Products	329.0	Crop Expenses	529.2
Crop Products	2761.0	Non-Crop Expenses	514.3
Capital Sales	960.0	Capital Purchases	0.0
Inventory Change if +	0.0	Inventory Change if -	65.5
Off-Farm Income	0.0	Non-Purchased Animal Feed	934.5
Total Gross Income LE	4050.0	Total Gross Expense LE	2043.5

NET FARM INCOME (with land appreciation) = 2006.5 LE
LAND APPRECIATION = 0.0 LE
NET FARM INCOME (without land appreciation) = 2006.5 LE

WORK DONE BY ANIMALS

Number of Animals							Hours Worked						
Cow	Buffalo	Calf	Donkey	Camel	Goat	Poultry	Plowing	Leveling	Puddling	Irrigation	Transportation	Other	Total
1	1	0	2	0	32	0	0.0	0.0	0.0	0.0	700.0	0.0	700.0

The information included in the summaries is sufficient to meet the Egypt Water Use and Management Project objectives of measuring farmer well-being. A comparative analysis of the farm records for the 1978 - 1979 and 1979 - 1980 farm record years has also been completed (1,2). In a forthcoming report, the farm records for the 1980 - 1981 farm record year will be analyzed with the 1979 - 1980 farm records to produce a comparative analysis over time.

4.2 Enterprise Cost Studies

The Egypt Water Use and Management Project farm records provide the necessary information relating to individual enterprises to be able to develop enterprise cost studies (budgets). Family labor and other farm resources utilized for production purposes in the farm records are valued at their opportunity cost or at the cost associated with a similar activity which was hired-in.

Enterprise cost studies for wheat produced at the three sites are presented in Tables 2, 3, 4. The units and prices included are the simple averages of the data from the farm record keepers producing the enterprise at the site. Income is based on the yield and price which the farmer received. The variable costs are based on the actual costs paid by the farmer or where necessary on opportunity costs. The price of chemical fertilizer is based on the actual prices paid by the farmer. When the farmer purchased fertilizer from both the cooperative and the free market a weighted average was computed for the price.

Fixed costs include land rent and a management charge. The land rent is computed at the legal rate, seven times taxes. The management charge is estimated based on the length of the crops growing period, the complexity of the agricultural operation, and the required expertise of the farmer.

These studies provide the means for comparing an enterprises production and costs. Since wheat is produced at the three project sites, three studies were completed. When comparing the three, one can see that income varies from L.E. 212 to L.E. 231 whereas the variable costs vary from L.E. 83 to L.E. 162, a significant difference. This is a good indication of the variation in production practices that occur at the project sites. This also reflects the importance of local conditions when evaluating the economic feasibility of irrigation alternatives.

The variable and fixed costs as estimated account for all the cash and non-cash costs incurred by the farmers in the production of wheat. Since water is provided to the farmers free of charge, the residual or return above all costs can be used as a measure of estimating return per cubic meter of

TABLE 2.

CROP ENTERPRISE COST STUDY
Wheat at Abyuha, El Minya Governorate, Winter 1980-1981 (1).
EGYPT WATER USE & MANAGEMENT PROJECT

Prepared by: Nabil Kamal Farag, Economics Discipline — Date Prepared: March, 1982

Item	Unit	Number of Units	Value Per Unit LE	Income or Cost LE
Income				
Wheat	Ardab	8.9	13.700	121.9
Wheat Straw (2)	Camel Load	7.7	14.200	109.3
Total Income				231.3
Variable Costs				
Land Preparation				
Plowing	Tractor Hour	4.3	1.400	6.0
Prepare Borders	Man Hour	41.2	0.180	7.4
Planting				
Seed	Kela	4.2	1.530	6.4
Labor for Planting	Man Hour	1.2	0.200	0.2
Chemical Fertilizer (3)				
Amonium Nitrate (33.5-0-0)	Kilogram	182.0	0.066	12.0
Labor to Spread Fertilizer	Man Hour	2.3	0.200	0.5
Irrigation (4)				
Labor to Spread Water	Man Hour	30.4	0.250	7.6
Harvesting				
Labor for Harvesting	Man Hour	87.1	0.200	17.4
Threshing	Machine Hour	5.3	1.800	9.5
Labor for Threshing	Man Hour	14.5	0.450	6.5
Winnowing	Man Hour	11.5	0.560	6.4
Transportation	Donkey Hour	14.9	0.050	0.7
Labor to Load & Drive An.	Man Hour	14.9	0.190	2.8
Total Variable Costs				83.7
Return Above Variable Costs				147.6
Fixed Costs				
Land Rent (5)	Month	7.0	7.600	53.2
Management Charge	Month	7.0	1.000	7.0
Total Fixed Costs				60.2
Grand Total Costs				143.9
Return Above All Costs				87.4

FOOTNOTES:
* This study for an area of one feddan.
EWUP Farm Record Data for Abueha, 1980-1981.
(1) Planted December 1-15, 1980; Harvested May 15-30, 1981.
(2) A camel load of straw weighs approximately 250 kilograms.
(3) The fertilizer price is the average price for fertilizer purchased from the co-op and the free market.
(4) Irrigation by gravity.
(5) The rental rate for land is computed as seven times the taxes (legal rental rate).

	LABOR DISTRIBUTION			WATER DISTRIBUTION, CU METERS			
	Man Hours	Woman Hours	Boy/Girl Hours	First Irrig.	Second Irrig.	Third Irrig.	Fourth Ir
November	41	0	0	0	0	0	0
December	12	0	0	413	332	0	0
January	0	0	0	0	0	0	0
February	6	0	0	643	0	0	0
March	11	0	0	410	353	0	0
April	6	0	0	297	0	0	0
May	128	0	0	0	0	0	0
June	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0
TOTAL	203	0	0	TOTAL WATER APPLIED = 2448 CU METERS			

Ratio of Return over Variable Costs to Water Applied = 0.0603
Ratio of Return over All Costs to Water Applied = 0.0357

FOOTNOTES:
* Water distribution quantities are based on EWUP engineering measurements.

TABLE 3.

CROP ENTERPRISE COST STUDY
Wheat at El Hammami, Giza Governorate, Winter 1980-1981
EGYPT WATER USE & MANAGEMENT PROJECT

Prepared by: El Shinnawi - Economics Discipline Date Prepared: February 1982

Item	Unit	Number of Units	Value Per Unit LE	Income or Cost LE
Income				
Wheat (1)	Ardab	10.0	12.000	120.0
Wheat Straw	Camel Load	9.0	12.000	108.0
Total Income				228.0
Variable Costs				
Land Preparation				
Plowing	Tractor Hour	2.0	6.000	12.0
Prepare Border	Man Hour	33.0	0.250	8.3
Planting				
Seed	Kela	5.5	1.100	6.1
Labor for Planting	Man Hour	26.0	0.250	6.5
Chemical Fertilizer (2)				
Phosphate (0-20.5-0)	Kilogram	260.0	0.053	13.8
Amonium Nitrate (33.5-0-0)	Kilogram	150.0	0.086	12.9
Labor to Spread Fertilizer	Man Hour	5.0	0.250	1.3
Weeding	Man Hour	130.0	0.200	26.0
Irrigation (3)				
Sakia Rental	Sakia Hour	28.0	0.075	2.1
Cow or Buffalo Rental	Animal Hour	28.0	0.400	11.2
Labor to Spread Water	Man Hour	28.0	0.250	7.0
Harvesting				
Labor for Cutting	Man Hour	48.0	0.250	12.0
Transportation				
Camel Rental	Animal Hour	8.5	0.750	6.4
Labor to Load	Man Hour	16.0	0.250	4.0
Threshing				
Tractor Rental	Tractor Hour	7.5	2.000	15.0
Labor for Threshing	Man Hour	7.5	0.250	1.9
Winnowing				
Machine Rental	Machine Hour	7.0	2.000	14.0
Labor for Winnowing	Man Hour	7.0	0.250	1.8
Total Variable Costs				162.0
Return Above Variable Costs				66.0
Fixed Costs				
Land Rent (4)	Month	7.0	7.000	49.0
Management Charge	Month	7.0	1.000	7.0
Total Fixed Costs				56.0
Grand Total Costs				218.0
Return Above All Costs				10.0

FOOTNOTES:

* This study for an area of one feddan.
EWUP Farm Record Data for El Hammami, 1980-1981.
(1) Wheat Planted from December 1 - 15, 1980; Harvested in May 1981.
(2) The fertilizer price is the average price for fertilizer purchased from the co-op and the free market.
(3) The average number of irrigation for wheat in this area is eight.
(4) The rental rate for land is computed as seven times taxes (legal rental rate).

	LABOR DISTRIBUTION			WATER DISTRIBUTION, CU METERS			
	Man Hours	Woman Hours	Boy/Girl Hours	First Irrig.	Second Irrig.	Third Irrig.	Fourth Irrig.
November	33	0	0	0	0	0	0
December	102	0	0	450	270	0	0
January	68	0	0	270	0	0	0
February	13	0	0	450	270	270	0
March	6	0	0	270	270	0	0
April	0	0	0	0	0	0	0
May	79	0	0	0	0	0	0
June	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0
TOTAL	301	0	0	TOTAL WATER APPLIED = 2520 CU METERS			

Ratio of Return over Variable Costs to Water Applied = 0.0262
Ratio of Return over All Costs to Water Applied = 0.0040

FOOTNOTES:

TABLE 4.

CROP ENTERPRISE COST STUDY
Wheat at Abu-Raya, Kafr El-Sheikh Governorate, Winter 1980-1981 (1)
EGYPT WATER USE & MANAGEMENT PROJECT

Prepared by: S. Elewa & M. Badawi, Economics Discipline — Date Prepared: July, 1982

Item	Unit	Number of Units	Value Per Unit LE	Income or Cost LE
Income				
Wheat	Ardab	10.3	11.500	118.5
Wheat Straw (2)	Camel Load	8.5	11.000	93.5
Total Income				212.0
Variable Costs				
Land Preparation				
Plowing	Tractor Hour	2.4	2.580	6.2
Smoothing	Tractor Hour	0.8	2.250	1.8
Planting				
Seed	Kela	5.4	1.140	6.2
Labor for Planting	Man Hour	1.5	0.250	0.4
Chemical Fertilizer (3)				
Urea (46-0-0)	Kilogram	130.0	0.097	12.6
Labor to Spred Fertilizer	Man Hour	1.8	0.250	0.5
Irrigation				
Labor to Spread Water	Man Hour	25.0	0.250	6.3
Sakia Rental	Sakia Hour	25.0	0.050	1.3
Cow or Buffalo Rental	Animal Hour	25.0	0.350	8.8
Labor to Drive Animal	Boy/Girl Hour	25.0	0.075	1.9
Harvesting				
Labor for Harvesting	Man Hour	54.0	0.200	10.8
Transportation				
Labor to Load	Man Hour	16.0	0.200	3.2
Camel Rental	Animal Hour	8.0	0.600	4.8
Threshing				
Tractor Rental	Tractor Hour	3.1	2.000	6.2
Labor for Threshing	Man Hour	10.9	4.300	46.9
Winnowing				
Machine Rental	Machine Hour	5.0	1.200	6.0
Labor for Winnowing	Man Hour	10.0	0.300	3.0
Total Variable Costs				126.6
Return Above Variable Costs				85.4
Fixed Costs				
Land Rent (4)	Month	7.0	4.680	32.8
Management Charge	Month	7.0	1.000	7.0
Total Fixed Costs				39.8
Grand Total Costs				166.3
Return Above All Costs				45.6

FOOTNOTES:
* This study for an area of one feddan.
EWUP Farm Record Data for Kafr El-Sheikh, 1980-1981.
(1) Wheat planted from November 1 - 15; Harvested in May.
(2) A camel load of straw weighs approximately 250 kilograms.
(3) The fertilizer price is the average price for fertilizer purchased from the co-op and the free market.
(4) The rental rate for land is computed as seven times taxes (legal rental rate).

	LABOR DISTRIBUTION			WATER DISTRIBUTION, CU METERS			
	Man Hours	Woman Hours	Boy/Girl Hours	First Irrig.	Second Irrig.	Third Irrig.	Fourth Irrig.
November	7	0	5	540	0	0	0
December	0	0	0	0	0	0	0
January	5	0	4	432	0	0	0
February	5	0	4	360	0	0	0
March	6	0	6	495	0	0	0
April	7	0	7	585	0	0	0
May	91	0	0	0	0	0	0
June	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0
TOTAL	119	0	25	TOTAL WATER APPLIED = 2412 CU METERS			

Ratio of Return over Variable Costs to Water Applied = 0.0354
Ratio of Return over All Costs to Water Applied = 0.0189

FOOTNOTES:
* Water distribtuion quantities are based on EWUP engineering measurements.

water applied. It should be acknowledged that this estimation of return to water does not represent the value of water in the production of these crops. This is mainly due to the differences that exist between the prices of input and products used in the cost studies and the prices of input and products under free market conditions. Referring to Tables 2, 3, 4 for the total water applied at each site, the ratio of return over all costs to water applied is the estimated return for water per cubic meter. The variation between L.E. 0.004 and L.E. 0.0375 is important and should be noted for future planning. One should also note that the differences in the costs associated with producing wheat at the three sites contributes to this variation.

4.3 Irrigation Scheduling

The date and area, by crop, of each irrigation can be obtained from the farm records. However, the information obtained from the farm records does not recognize differences in the amount of water applied (a) among different irrigations for a given crop or (b) between crops. By totaling for each crop the number of irrigations times the number of feddans, the total feddans of all crops irrigated for a given period can be determined.

The crop year in the farm record system begins on November 1, and continues through the month of October in the subsequent year. An irrigation schedule was developed by dividing each month of the crop year into two periods; the first is from day 1 to 15 and the second is from day 16 to the end of the month. Since no irrigations occurred during the two periods of winter closure, a total of twenty two periods were defined.

The Abyuha Site farm records for 1979 - 1980 are used to illustrate the procedure. The farm records represent a total area of approximately 55 feddans, with the individual farms ranging in size from 0.5 feddan to 14.7 feddans. The bar graph, Figure 2, indicates the number of feddans irrigated during each of the twenty four periods. The greatest number of feddans irrigated came in the period immediately following the closure period when 50 feddans, 90 percent of the area, were irrigated. The periods from June 15 to August 15 as depicted on the graph are consistent with the periods of high consumption for the crops produced in the area.

The bar graphs make it easy to recognize those periods when the quantity of water being used is high, and therefore should help with the scheduling of water to accommodate the periods of high water use.

The results of a preliminary study showing the relationship of the percent of the area irrigated during a given period to the amount of water discharged

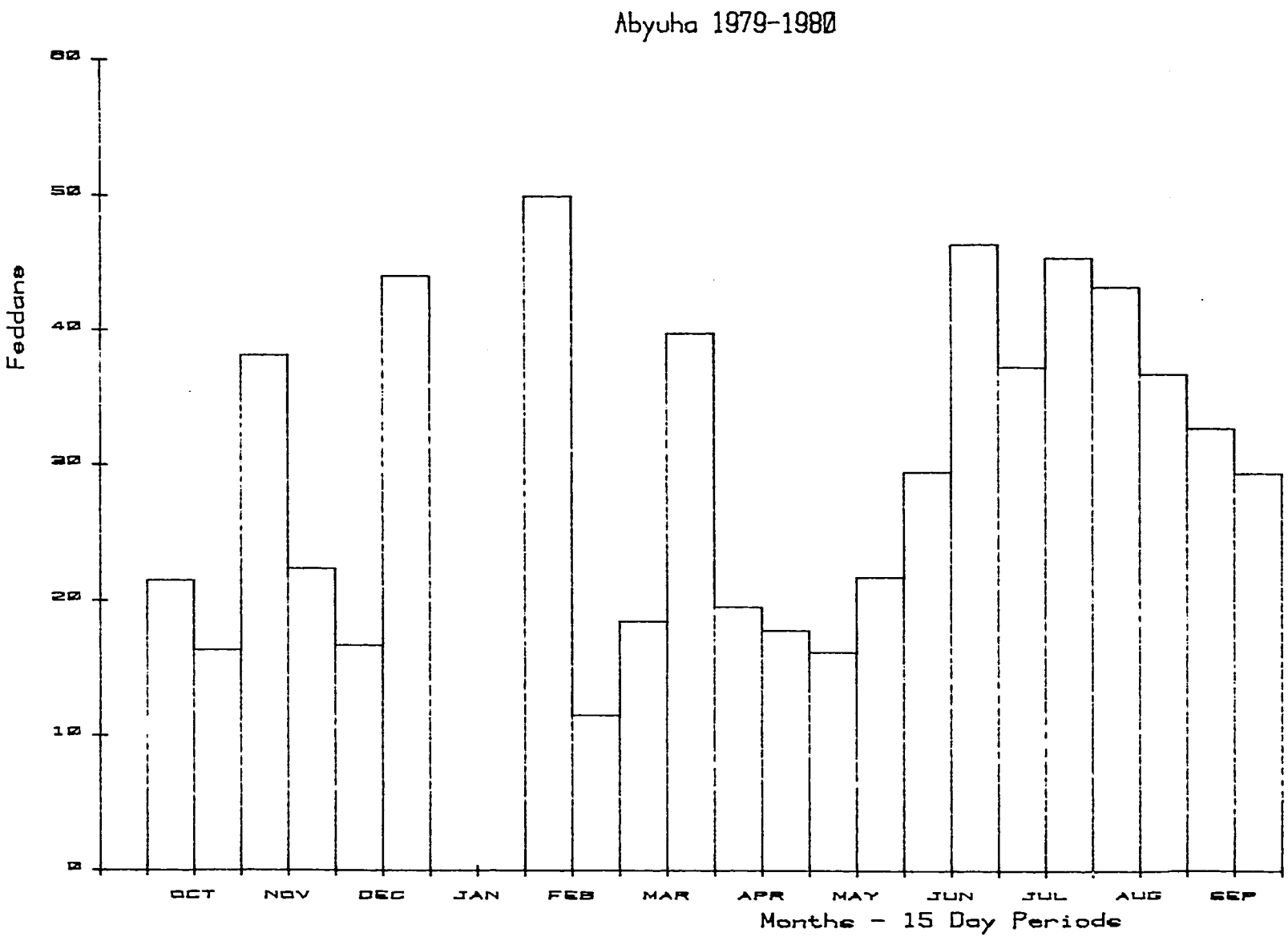

Figure 2. Area Irrigated by Farm Record Keepers, Abyuha 1979-1980

into the main canal feeding the area during the same period is shown in Figure 3. The collection of discharge data for the Abyuha canal started in April 1980 and was collected by the water budget task group in the Egypt Water Use and Management Project project.

Although data were not available for the period with the highest percent of area irrigated, an analysis of other periods of high consumptive use was possible. From the graph, one can see that those periods with high (low) discharge into the canal did not always correspond to a high (low) percentage of the area irrigated.

This approach may be rather naive. Nevertheless, it can serve as a beginning or basis in the formulation of a procedure for water management utilizing not only farm record data for an area but also water budget data for that same area.

5. SUMMARY

The Egypt Water Use and Management Project is implementing several viable on-farm management alternatives, alternatives which emphasize on-farm water management, having significant economic and social impact for the Egyptian farmer. The interdisciplinary team of trained experts plays an important role in the technology transfer associated with these on-farm management alternatives.

The economic analysis in the Egypt Water Use and Management Project revolves around a farm record system. The farm record system was developed as a tool for use in monitoring and planning on-farm management alternatives. This system provides the data to evaluate the relative contributions of alternative enterprises to farm income, to delineate the production activities for each enterprise, to determine factors which limit operating decisions, to understand cash flows for both production expenses and farm product sales, and to enable comparisons with other farmers following similar practices.

Using the data from the farm records and data on water application to develop enterprise cost studies allows for estimating returns to water. These estimates are important for future planning. The use of farm record data and water budget data lends insight into the problem of water scheduling.

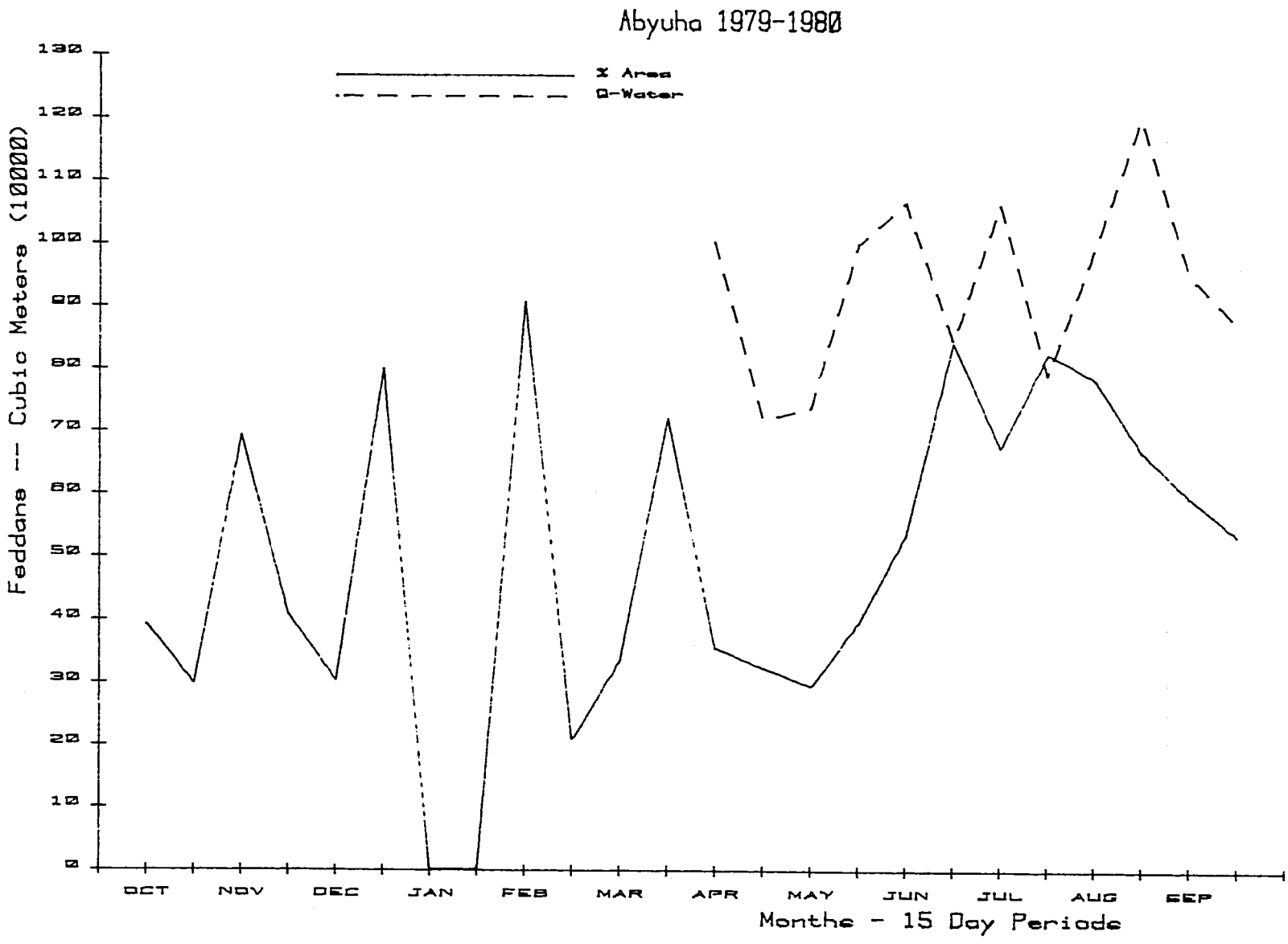

Figure 3. Percent of Area Irrigated and Discharge into Abyuha Canal, Abyuha 1979-180

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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

fara[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.)