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PROBLEM IDENTIFICATION REPORT

FOR MANSOURIA STUDY AREA 2630017

October 1977 to October 1978

EWUP Technical Report No. 1

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All reported opinions, conclusions or
recommendations are those of the
author and not those of the funding
agency of the United States Government.

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March 1979

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## Preface

This report was prepared by the staff of the Egyptian Water Use and Management Project. The project is funded by the U. S. Agency for International Development, under a grant agreement between the United States of America and the Arab Republic of Egypt. Dr. D. S. Brown is the Mission Director USAID and Mr. Niel Dimick is Project Manager USAID.

The project is in the Water Management and Irrigation Technologies Research Institute, Dr. M. Abu-Zeid, Director, Ministry of Irrigation but the Ministry of Agriculture has a collaborative role with the Soil and Water Research Institute, Dr. A. Serry, Director and the Agricultural Economics Institute, Dr. G. Hindy, Undersecretary, providing personnel and services.

The Consortium for International Development with executive offices in Logan, Utah is the contractor with Colorado State University as the lead university for the project. American personnel on the project are from Colorado State University, Oregon State University and Montana State University.

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Texas Tech University
University of California
University of Arizona
University of Idaho
Utah State University
Washington State University

Arab Republic Of Egypt

Ministry of Irrigation
Ministry of Agriculture

United States Of America

Agency for International Development

# CONVERSION FACTORS[1/]

| 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 | = | $100 \times 10^4$ | = | 247.105 | = | 238.048 | = | 100 |
| 1 sq mile | = | $259 \times 10^6$ | = | 640 | = | 616.4 | = | 259 |

Water Use:

| | |
|---|---|
| 1 billion $m^3$ | = 810,710 acre-feet |
| 1,000 $m^3$ | = 0.81071 acre-foot = 9.72852 acre-inch |
| 1,000 $m^3$/feddan | = 0.781 acre-foot/acre = 9.372 acre-inch/acre |
| | = 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 |
| Sugar, onion, flax straw | Kantar | 45.0 | 99.12 |
| Rice (rough or unmilled) | Dariba | 945.0 | 2081.50 |
| Lentils | Ardeb | 160.0 | 352.42 |
| Clover | Ardeb | 157.0 | 345.81 |
| Broadbeans, fenugreek | Ardeb | 155.0 | 341.41 |
| Wheat, chickpeas, lupine | Ardeb | 150.0 | 330.40 |
| Maize, Sorghum | Ardeb | 140.0 | 308.37 |
| Linseed | Ardeb | 122.0 | 268.72 |
| Barley, cottonseed, sesame | Ardeb | 120.0 | 264.32 |
| Groundnuts (in shells) | Ardeb | 75.0 | 165.20 |

Other

| | | |
|---|---|---|
| 1 ardeb | = | 198 liters = 5.62 bushels (U.S.) |
| 1 ardeb/feddan | = | 5.41 bushels/acre |
| 1 kg/feddan | = | 2.12 lb/acre |

[1/] From Contemporary Egyptian Agriculture, by H. A. Tobgy.

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# PROBLEM IDENTIFICATION REPORT
# FOR THE MANSOURIA STUDY AREA
# OF THE EGYPT WATER USE AND MANAGEMENT PROJECT

## ABSTRACT

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 formulation of the project that the management of 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.

Thus, the Egypt Water Use and Management Project constitutes a new strategy for irrigation development both in approach to project activities and in staffing. Project activities are designed to facilitate farmer innovation through an interdisciplinary research and development procedure. This procedure includes problem identification, search for solutions, testing solutions on-site, and diffusion of effective alternatives. The EWUP team includes agronomists, engineers, economists and sociologists from both the United States and Egypt. This team is working with the Egyptian farmer at the field level in an effort to find out what is being done and what viable alternatives given both physical and institutional constraints--exist for improving on-farm management practices.

Problem identification constitutes a major activity of EWUP in this context. For it is the base on which improved on-farm management practices can be formulated and demonstrated. The initial six-month

problem identification activity was carried out in an area representative of current Egyptian agricultural practices. Several case study farms were selected in two study sites. These study farms received intensive attention from all disciplines involved in the project. During efforts at problem identification, both teamwork and actual research activities have been of concern. This dual concern is reflected in the organization of this paper. The first section deals rather exclusively with project organization, procedures and activities while specific on-farm research findings constitute the remainder of the report.

The findings reported reflect the concerns of all the disciplinary contexts but are reported mainly from the perspective of the specific discipline which undertook the investigation. As reflected in the last section of this paper, since project concerns have moved into the on-farm field trials, the need and value of a truly interdisciplinary mode has emerged with full cooperation among all disciplines in these efforts.

## INTRODUCTION

The Egypt Water Use and Management Project (EWUP) pilot area research and demonstration programs are designed to assist in improving existing management practices of irrigated agriculture in Egypt. Central to all project activities is the accomplishment of significant social and economic progress for Egyptian farmers. Such achievements depend on the development and demonstration of improved practices suitable for use by the typical Egyptian farmer. Of specific concern to EWUP is the improved management of water, soil, capital and human resources used in agricultural production.

The purpose of this paper is to present some preliminary conclusions from the problem identification phase of the project as it pertains to Mansouria irrigation district. This will be accomplished by presenting the organizational structure of the project and summarizing the innovative research approach that was used to identify problems. Other related project activities will then be presented to acquaint the reader with the full scope of the project. Finally, tentative conclusions will be presented including some possible solutions that seem potentially productive and satisfy project objectives.

## PROJECT PLANNING AND DEVELOPMENT

The project was developed from its formulation as an interdisciplinary research activity. Rooted in earlier experiences in Pakistan, EWUP was developed to capitalize on the advantages of combining irrigation engineers, agronomists, agricultural economists and rural sociologists in a unified interdisciplinary team for the development and implementation of the research extension design.

Project Organization

The project has been organized to maximize technical input and support to accomplish improved on-farm management. Implementation of project plans for a given area may be visualized by the organizational chart shown in Figure 1. The Project Directors have an Egyptian Advisory Committee and a U.S. Planning and Coordinating Committee to assist them in all aspects of project implementation. A senior staff of American specialists (discipline leaders) working with a senior staff of Egyptian specialists provide the necessary technical expertise to carry out project objectives in three project areas in Egypt--Mansouria, El Minya and Kafr El Sheikh.

Role of Discipline Leaders: Experienced technical experts from the United States have been brought together to work with experienced Egyptian experts in each discipline. These discipline leaders plan and direct all technical activities in the project areas. The discipline leaders evaluate the technical progress periodically and reassess plans accordingly. They meet with the Project Directors to report technical accomplishments, make evaluations and plan for the achievement of project goals.

These four discipline leaders and Egyptian counterparts act as an interdisciplinary team in planning project goals. To accomplish these goals professionals in the corresponding disciplines, called a field team carry out work plans developed with their discipline leaders. Team members in the field look to the senior staff for training and assistance in carrying out work assignments. Training and proper technical supervision help assure that quality data and information are collected. The discipline leaders have complete responsibility for monitoring data quality and data analysis within each discipline.

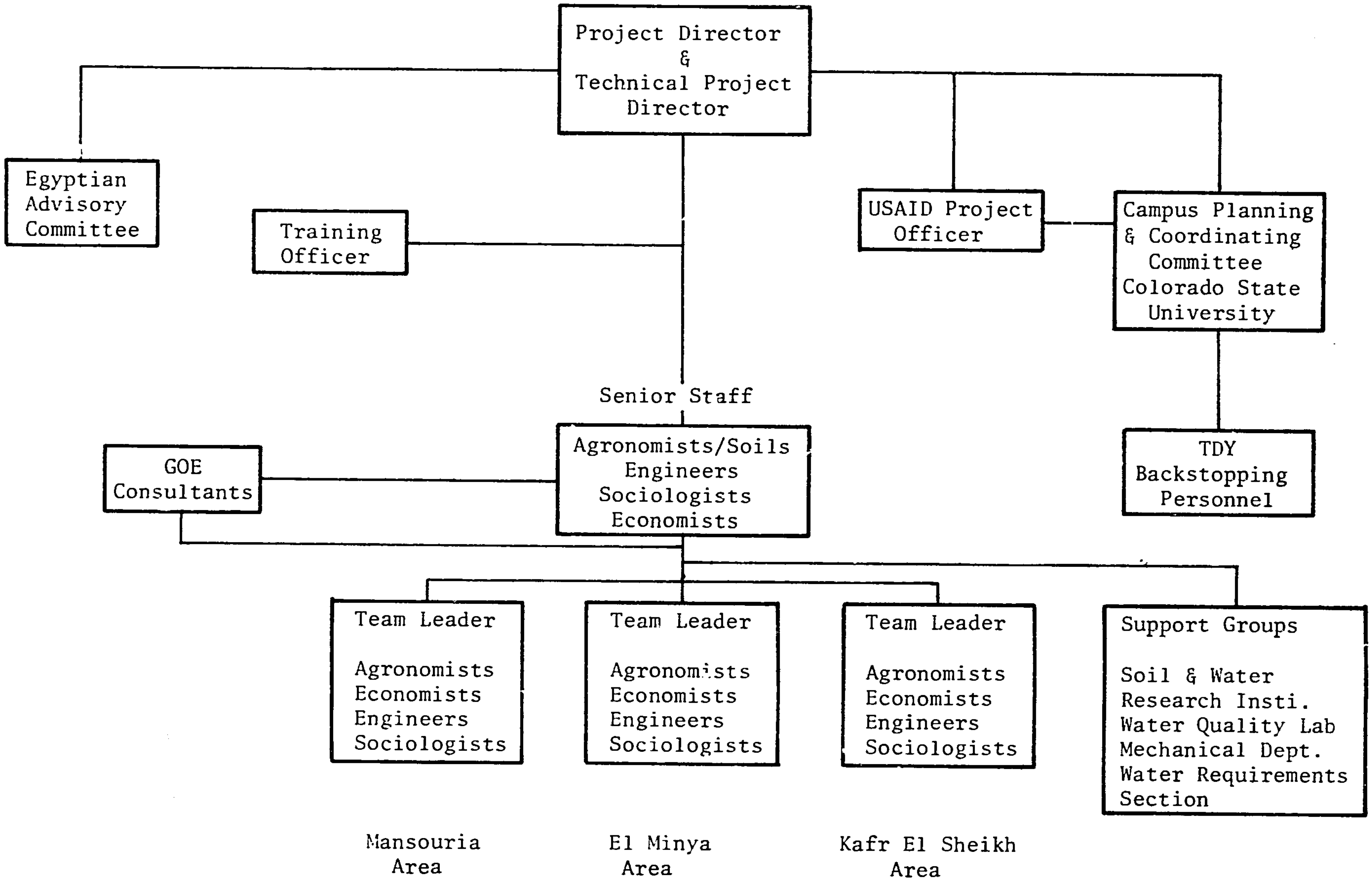


Figure 1. Organizational Chart for Egypt Water Use and Management Project (EWUP).

Role of Team Leaders: The field team leader directs the technical work as a facilitator and motivator so the work is accomplished as outlined by the senior staff in the work plan. The senior staff must work closely with the team leader to communicate work plans and special technical activities. Although the team leader is a trained specialist, the role carries no responsibility for training personnel in other disciplines. However, he should discuss with other discipline leaders the needs for modifying their training programs to best achieve the project goals. As a manager, the team leader facilitates the work by organizing all of the resources available for accomplishing work plans.

Project Procedures for Problem Identification

The relationship of some of the most basic hypothesized potentials for improving agricultural production are summarized in Table 1. By investigating these basic conditions an understanding of present farm system operation can be achieved. Specifically the objective of problem identification is to identify and characterize major physical, hydrological, chemical, biological, economic and organizational factors which constitute significant potentials for increasing crop production.

Detailed Problem Identification Procedures: The Mansouria irrigation district research area was selected to represent one typical set of soils, cropping and irrigation patterns in Egypt. Within the irrigation district, hydrologic units form the major level of analysis. The area was selcted because of its accessibility from project headquarters as well as its resemblance to agricultural and rural life patterns in areas of the country characterized by high population density and proximity to urban centers. In addition, the Water Distribution and Irrigation

TABLE 1. Summary of Hypothesized Potentials for Improvement in Irrigated Agriculture.

| BASIC CONDITIONS | FOCAL FACTORS | ENVIRONMENTAL BENEFITS | PRODUCTION BENEFITS | SOCIETAL BENEFITS |
|---|---|---|---|---|
| Agricultural management knowledge: water, soil, capital and human resource management; motivation and management to realize optimal productivity.<br>Project Emphasis: APPLIED RESEARCH AND DEVELOPMENT<br><br>Cultural patterns (commonly held and socially reinforced behaviors and beliefs) which represent constraints opportunities to effective irrigated agriculture.<br>Project Emphasis: INVESTIGATE IN PROBLEM IDENTIFICATION PHASE; UTILIZE IN TESTING, ASSESSING AND IMPLEMENTING<br><br>Capital and technological opportunities constraints on farm level management.<br>Project Emphasis: DEVELOPMENT AND APPLICATION OF COST-EFFICIENT ALTERNATIVE TECHNOLOGIES WHICH REPRESENT FEASIBLE FARMER CAPITAL INVESTMENTS<br><br>Institutional organization, including communications and consistency of actions among and between farmers, scientists and government officials. Farm policy constraints and potentials for the effective practice of rational and efficient irrigated agriculture.<br>Project Emphasis: STRENGTHEN INSTITUTIONAL SUPPORT FOR INNOVATIVE AGRICULTURAL PRACTICE | 1. Agricultural--production factors including irrigation water, fertilizers, plant populations, labor, capital investment, farmer cooperation patterns etc.<br><br>2. Institutional--timing in delivery or application of production factors; regulations and policy; government and private services; banking and credit, etc. | 1. Reduced salinity accumulations in soils.<br><br>2. Reduced waterlogging of previously arable land.<br><br>3. Reduced water use. | 1. Stabilized or increased agricultural productivity.<br><br>2. Increased production efficiencies.<br><br>3. Long-run agricultural productivity both due to increased fertility of crop lands and to saved irrigation water and other production factors which can be used for the development of new lands. | 1. Improved farm family socio-economic well-being.<br><br>2. Reduced annual labor for on-farm production.<br><br>3. Improved national socio-economic well-being. |

Systems Research Institute, into which the project has been administratively absorbed, was already working there.

In the Mansouria irrigation district the hydrological units are the Kafret Nasar, Beni Magdoul and El Hammami water courses. They are shown in the general area map in Figure 2. The Beni Magdoul and El Hammami water courses are shown in Figure 3. Each area is bounded by conveyance and drainage channels to form a hydrologic unit. Although there are several villages within each hydrologic area, a village may be served by more than one water course. For the purposes of problem identification all teams focused their surveys on the hydrological units so hydrological, agronomic and socio-economic data could be correlated. The socio-economic disciplines also required some village level data.

Data collected during the problem identification survey provide baseline data. Insights and guidelines for developing programs for transfer of findings to other farmers also result.

On-Farm Agronomic Survey

Agronomic Practices Survey: Field observations were made for plant growth characteristics, soil characteristics, agronomic management and irrigation practices. In addition, field measurements were taken to quantify the soil-plant-water system in the field. Both the soil physical-chemical properties and crop growth factors including yield, plant stands, root system and diseases and pests were measured.

Soil and Land Classification Survey (Beni Magdoul and El Hammami): A general surface and sub-surface texture survey were taken to determine structure, consistency, color, mottling depth and water table location. Soil profiles from representative sites were analyzed for exchange capacity, exchangeable sodium and water soluble salts, pH, gypsum

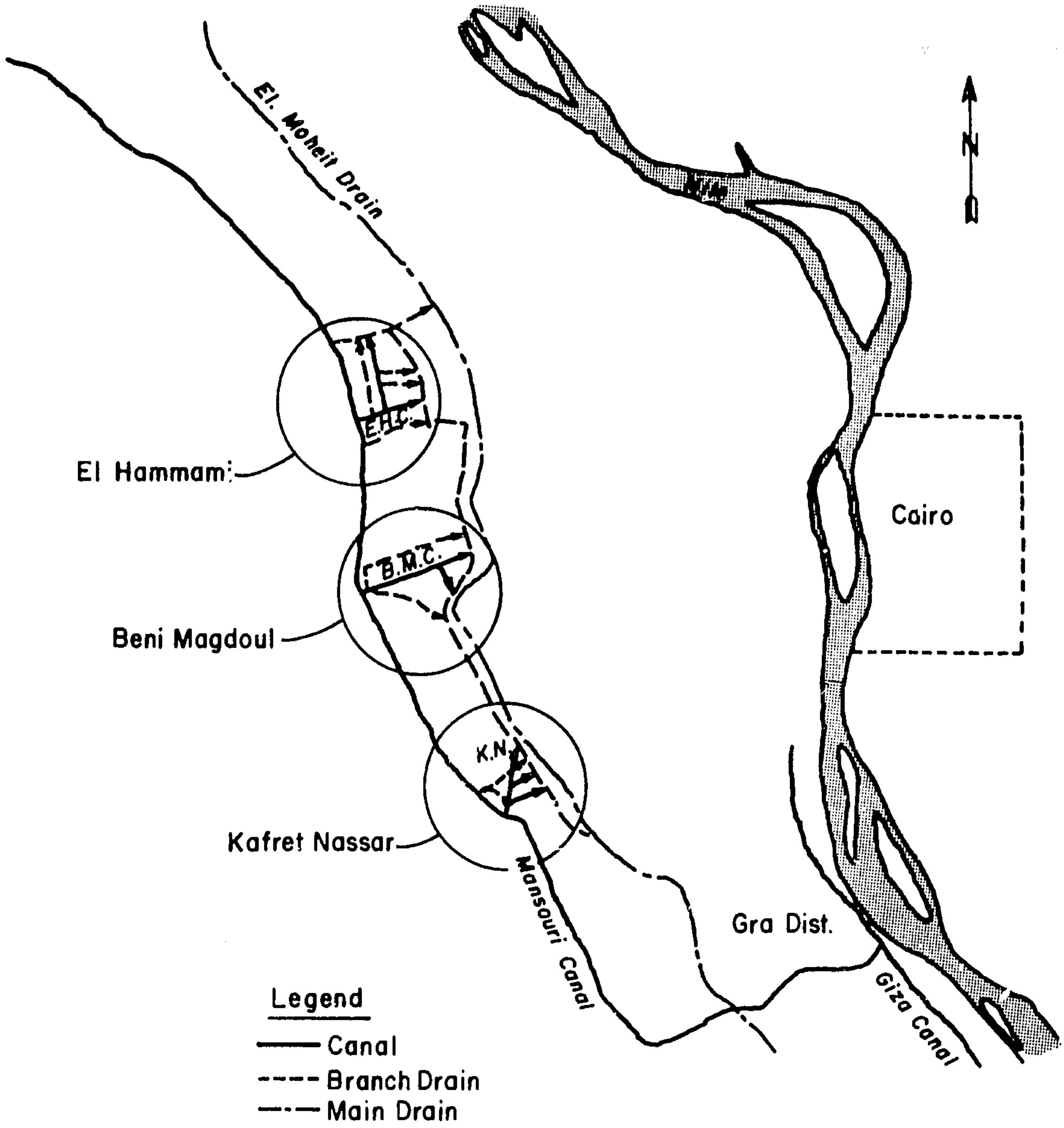


Figure 2. Map of the Mansouria Irrigation District showing the El Hammami, Beni Magdoul and Kafret Nassar study areas.

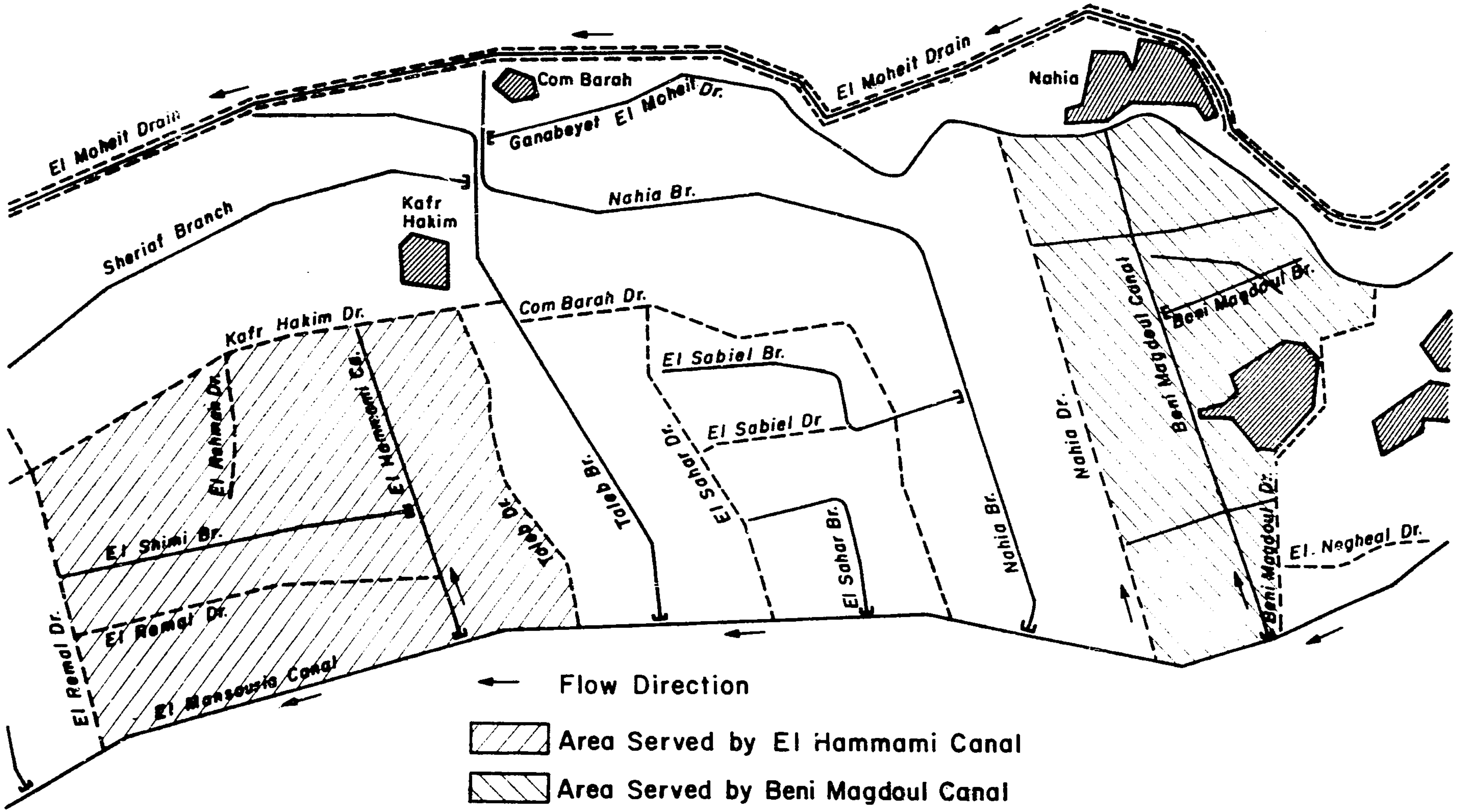


Figure 3. General layout and boundaries of the Beni Magdoul and El Hammami water courses.

requirement, soil organic matter, soil fertility analysis, lime and a moisture curve.

Soil Testing Survey: An extensive soil testing survey was made to identify fertility problems in the village so that sampling procedures can be designed for fertilizer recommendations.

## Engineering Survey

The engineering discipline was involved in two major problem identification activities. They were (1) an on-farm water management survey and (2) a water budget study.

On-Farm Water Management Survey: The objectives of this survey was to find out what is happening to irrigation water being applied to selected tracts of land and why and to what degree the irrigation process may be creating an undesirable moisture regime in the normal root zone. The study involves obtaining a complete water budget for selected fields to learn where losses are occurring and the magnitude of such losses. Also, existing irrigation practices, methods, scheduling, physical land features, crops, etc., are analyzed for their correlation with water loss. At the same time a running account is kept of the moisture status in the soil, the depth to water table, and the best available estimate of crop yield. Seven sites were selected in Beni Magdoul, one in Kafret Nassar and eight in El Hammami. In Beni Magdoul and also in El Hammami, only four sites received intensive measurements. For the others, limited measurement of water table and irrigation schedules have been recorded.

Water Budget Survey: The water budget for the Mansouria area consists of measuring surface flows, ground water flows and evapotranspiration. Specific methods for measuring surface flows such as cutthroat flumes were selected for all sites. Exact location of many installations, such as observation wells and flumes, by necessity are determined based upon the available field data as it becomes available.

It is anticipated that these limited measurements can also provide an estimate of seepage losses from the Mansouria Canal. In general, flow in the canal can vary appreciably within a few hours, since the water control is based on maintaining a constant water level instead of a constant discharge. Thus, unless a calibrated control section or measuring device with a recorder is available in the channel, accurate continuous measurement is impractical.

Socio-Economic Survey

This survey provided information about the operational procedures and major types of socio-economic data. The survey consisted of three basic parts given below.

Review of Literature: Literature and available data in English and Arabic were reviewed both in Egypt and the United States. Data were obtained from Egyptian Research Institutes, FAO, Ford Foundation and other organizations working in Egypt. Relevant population and economic statistics from Egyptian and international agencies were obtained whenever available in published form.

Problem Identification Field Surveys: Preliminary field surveys were conducted to provide information for the development of the formal problem identification surveys. Twenty-two farm operators were chosen for socio-economic case studies in the Mansouria Irrigation District; ten of these were in Beni Magdoul and 12 were in El Hammami. The sources of data were key informants from the area including cooperative extension and irrigation personnel plus the decision makers of the case study farms. These farms were chosen to indicate various size holdings, ownership and employment patterns. In addition, field observations of activities were conducted.

Subsequent Research Activities: Data obtained during the problem identification phase has led to the selection of subjects for specialized socio-economic research and detailed continuation research based on results from first-phase investigations. Specialized studies may include such questions as urban encroachment on agricultural lands, joint-family operations, decision making, rural out-migration, socio-economic consequences of mechanization as appears relevant to project objectives.

Socio-Economic Field Trial Activities

Field trial activities are central to project objectives. Solutions are being sought immediately for priority problems already identified in the field surveys. Also some known technologies for problems already identified are being applied and evaluated. For example, changes created within the system by lining water courses ae being evaluated where they appear feasible.

Assessment of Applied Technologies: Each of the technologies applied will be evaluated in terms of farmer acceptability, cost-benefit, social and environmental impacts (using BEFORE and AFTER data). They are developing specific assessment methods in consultation with the engineers and agronomists. The interpretation and the reporting of these findings requires the participation of all team members.

Technology Transfer: When a technical solution to a significant problem is adequately evaluated and there is substantial evidence of its benefit to farmers, plans are developed for its transfer to other farmers in the area. Diffusion of this technological package requires the organization and development of institutional requisites in a communication package. Also, training of agricultural extension workers, village level agriculture advisors and farmers must be planned and implemented. The major responsibility for technology transfer lies on the socio-economic team with assistance from other team members.

The socio-economic team is also responsible for evaluation of the adoption and diffusion rates of the new technologies over time. The infrastructural requirements necessary for widespread diffusion of the technologies need special attention since these technologies may require new or improved agricultural services, organizational changes and incentive systems for farmers.

Procedures for Team Coordination and Cooperation

Continuous collaboration and full communication among team members has proved essential because of the interdisciplinary nature of the project. Since one team collects information that may be needed by other teams, it has been critical that all data be tabulated, summarized and made available for all project members as soon as possible. Also, special meetings have been held in order to review progress and to plan subsequent activities, and preliminary summaries of data have been developed, including this one.

The Project Director and Technical Director have primary responsibility for coordination of efforts and for full cooperation among team members. Each team member, however, must be responsible for full dedication in the cooperative effort to attain the goals of the project.

## PROJECT ACTIVITIES

Project operations commenced in September 1977 with a United States training period for most senior Egyptian staff. Remodeling and preparation of a project main office in association with the building occupied by the Water Distribution and Irrigation Systems Research Institute in the Ministry of Irrigation was completed by January 1978. These facilities provided space for the discipline leaders and counterparts as well as the Mansouria field team. As staff members began to gain familiarity with each other's subject matter, the process and problems of interdisciplinary applied research were explored. Finally, a preliminary work plan was developed.

In January 1978 staffing of the Cairo main office team was completed and the Mansouria District problem identification study began with the following activities:

1. Training of junior staff, as well as continued junior staff selection.
2. Continued collection of relevant secondary data and a comprehensive literature search.
3. Acquisition of equipment and familiarization of personnel with the Mansouria District.
4. Selection of two field study areas, Beni Magdoul and El Hammami (see Map 2).

### Field Activities

As the study areas were being determined, it became apparent that interdisciplinary planning of field operations was needed. Each discipline had its own set of criteria for site selection, including soil characteristics, size of farm, location of the ditch, operator's personal characteristics. Therefore, some standard sampling procedure suitable to the disciplines was required. Once this was established, a limited number of common case study farm sites were selected, and actual field activities as described below commenced.

Agronomic Team: The agronomic group completed soil sampling in the El Hammami and Beni Magdoul areas. Three hundred and eight samples from 80 farms were obtained from the Beni Magdoul area and an equal number were taken from 90 sites in the El Hammami area. Observations of agronomic practices in the area are still being continuously recorded. The socio-economic group also gathered relevant agronomic data from the individual farmers. An agronomist was often with the socio-economic team during the first round of interviews with the farmer.

Engineering Team: On-farm irrigation methods have been observed and documented to define the irrigation problems of typical farmers. Discharge measurements into small branch ditches and from the branch ditches to field ditches have been made to obtain information on the quantity of water utilized by the farmers. Ground water observation wells were installed and water levels are being recorded daily. Measurements of discharge at the head of all three branch canals have been started also. Four sites of land in Beni Magdoul area are receiving concentrated study on existing water management procedures. Four additional sites in Beni Magdoul are receiving a less intensive study. At El Hammami four sites have been selected for intensive study and two others to receive limited study. The field site locations are noted in Figure 4 for the Beni Magdoul and El Hammami water courses.

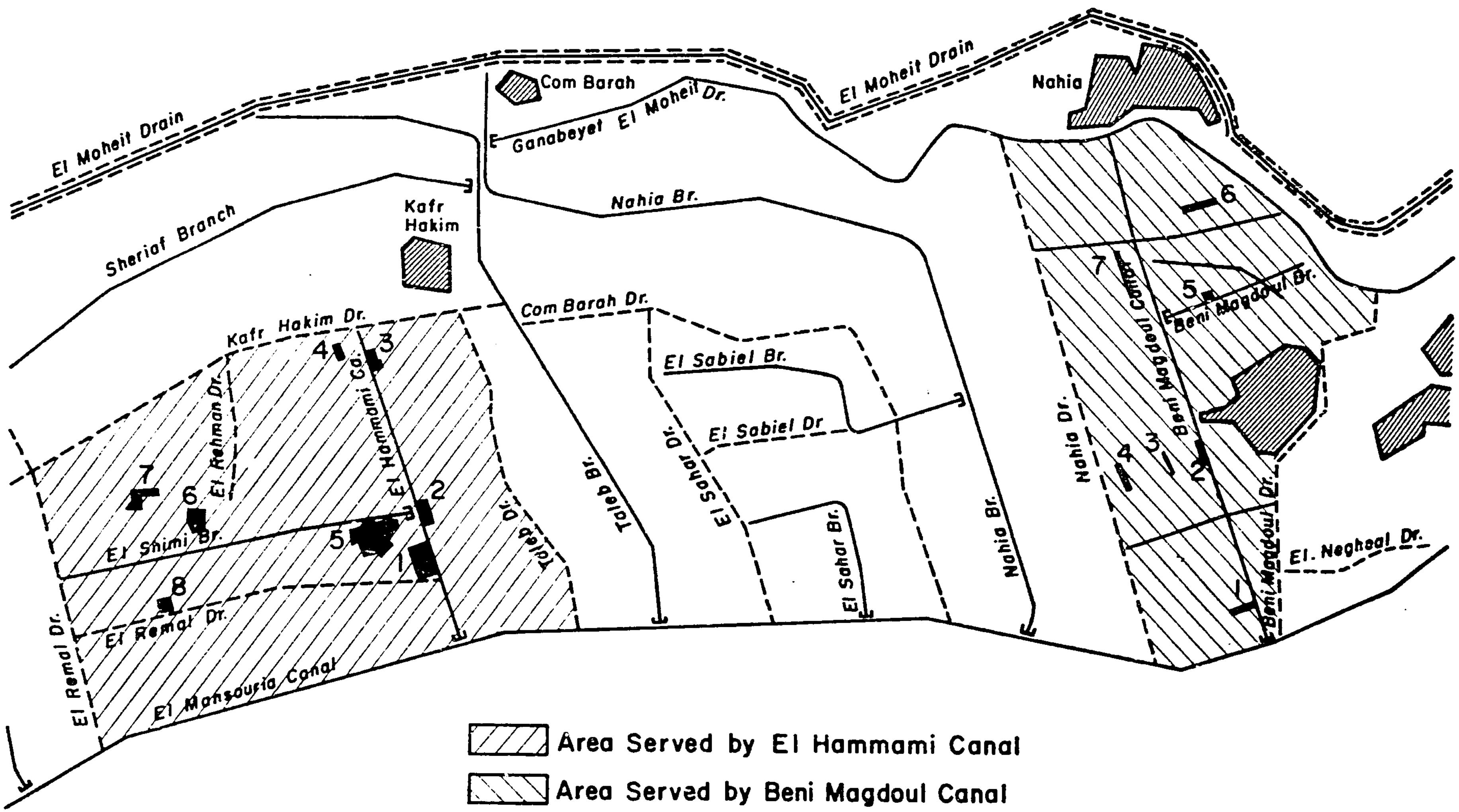


Figure 4. Farm site locations at which more or less intensive studies are made in Beni Magdoul and El Hammami.

On-farm measurements include irrigation scheduling (frequency, amount, duration, time/day), surface disposal of excess water if any, methods of distributing over the land surface, quantity of water applied, degree of land leveling, soil moisture status, and water table level. In addition soil bulk density values have been provided by the agronomy group. This detailed work will permit, for the first time, calculations of the application efficiency and the on-farm water budget. The engineering group also contracted for a local supply of observation wells, cutthroat flumes, infiltrometers, and class A evaporation pans. In addition ground water observations are being continuously recorded by using piezometers and observation wells.

Socio-Economic Team: The socio-economic team developed and field tested farmer interview forms to obtain data on crop production, ownership, population characteristics in the area. Many of the farmers in the area were interviewed.

Preliminary financial analysis of several small farms in the area was made and the study of the economic feasibility of lining the Beni Magdoul and other branch canals was started. Also an analysis of pumping costs was made. Farm budget analysis of one farm was made to test the format and procedures, subsequently further farm budget data was collected.

Training

On-the-job training including water measurement, observation of agronomic practice, soil sampling, soil analysis, socio-economic studies, social and economic surveys, installation of piezometers and observation wells, evaluation of soil bulk density, installation of Parshall and cutthroat flumes, observation of farming practices, continues on a day-to-day basis with project personnel.

## THE MANSOURIA IRRIGATION DISTRICT AND RESEARCH SITES

Generally, the Mansouria District is very picturesque. It contains antiquities and the desert at its edge. Lush fields and orchards flourish throughout most of the land unless occupied by modern urban development or villages. Amid the visual appeal, however, there are many needs. Some of these are technical, some economic and some social. These are the aspects which receive attention in the analysis to follow, for they form the focus of both problem identification and subsequent project activities.

### The Mansouria Area: An Overview

Two areas were selected as representative of the Mansouria Irrigation District. They are (1) the land along the Beni Magdoul Branch Canal, and (2) the land surrounding the El Hammami Branch Canal as shown in Figure 3. Neither have any administrative status beyond being water command areas of the branch canals. The first, in fact, contains some, but not all, of the land falling in the territory of four separate villages; the second is part of the territory of one village. Both areas fall within the Imbaba District of the Giza Governate. Some physical, agronomic, irrigation and socio-economic characteristics of the area follow.

Physical Geography: (1) The area served by Mansouria District has an elongated strip shape of an average length of 30.000 kilometers from south to north and an average width of 3.500 kilo. (2) The total area of the district is 24,745 feddans (23,838 acres) located mostly west of Mohiet Drain. (3) The extreme western boundary of the Mansouria District extends to the western desert fringe.

The land throughout almost all of the Mansouria irrigation district is a very flat flood plain. Some variation in the elevation of the irrigated fields does exist but mostly within $\pm 0.5$ m from the mean of any east-west profile. The overall gradient in the canal system from south to north is about 10 cm per km. The terrain becomes more irregular west of the Mansouria Canal on the edge of the desert.

The climate is warm and sunny, ranging from a daily average maximum of 20°C in January to 36°C in July; night minimum averages are 8°C and 22°C, respectively. Precipitation occurs during a portion of only five days a year, on the average, and measures less than 3 cm total annual accumulation.

Water Resources: The area is mostly fed by Mansouria Canal, a branch of the Giza Main Canal. The Mansouria Canal is 37 kilometers long and discharges about 650,000 $m^3$/day. Some water is recaptured from the drains by pumping. This water ranges from 800 to 1200 ppm, TDS.

A fairly shallow ground water aquifer, 35 meters or less, is tapped in a few places in the Mansouria District to yield supplemental irrigation water. Usually these wells are located near the end of a canal or ditch or at any other place where the system does not always supply an adequate, dependable stream.

Political Geography: The Mansouria district is an irrigation administrative unit that does not correspond with the boundaries of any other political unit. It is located within the Giza Governate, and contains approximately 180 villages and 7 towns and cities, and 2,419,247 people, many of whom (1,379,277) are part of the Cairo-Giza metropolitan unit. Farmers in this area live in compact villages or sub-villages.

Proximity to Cairo, Giza and Egypt's major pyramid complex has made Mansouria an area of extensive urban encroachment. Land values are extremely high, and farm holdings are small, even by Egyptian averages. A high proportion of part-time and non-farming residents and a relatively high number of non-farm related income opportunities exist. Observers of the agricultural patterns and village life in this district frequently judge it to be a "garden" form of agriculture.

Again, due to proximity to Cairo, the Mansouria district is exempt from the many government crop allocation policies. In addition, certain other national policies including many of the restrictions controlling residential and industrial development on agricultural land are waived. Furthermore, working animals and poultry are more common than in other national areas due to the large, accessible market.

Government services provided at the village level of the district include schools, health care, water supply for domestic use. There are also agricultural cooperative and village bank services, religious centers, roads and some public transportation, and local administrative and law enforcement functions.

Cropping Patterns

Two or three croppings occur annually in this district. The most common winter field crops are berseem clover, flax, vegetables, wheat and beans; summer field crops include maize and vegetables. These variations are determined both by climatic conditions and government regulations which prohibit the cultivation of some crops in the summer. Many orchard crops are grown, including citrus, mangoes and dates. There are vineyards and some specialty crops like flowers are also grown year-round. Intercropping occurs frequently.

## Irrigation and Drainage System

Physical and Operational Description: The district irrigation delivery and drainage system is rather typical of the country. The supply canals were laid out earlier in the century. Most are unlined, although a concrete lining program is being carried out at Beni Magdoul. Generally, the canals and drains consist of straight conveyance channels. These are arranged more in a grid pattern than a "snaking" or "branching" pattern. The water is traditionally delivered on a rotation schedule; however, the district contains a few experimental continuous-supply areas including the project's study area at Beni Magdoul.

Specifically, a three-phase rotation system is applied in this district. The rotation in general is a 4-day-on and 8-day-off cycle. However, there is deviation in this rule of rotation in this canal due to the inequity of the region's acreage and the sandy soil in the tail region as compared with the other regions.

To satisfy the standard of fairness in water distribution, during the "on" period of Reach B, a part of the canal discharge is diverted to Reach A during the first two days; during the last two days a part of the discharge is diverted to Reach C. A further complication is that the Beni Magdoul Canal in Reach C is permitted to flow continuously during all rotations. This is shown diagrammatically in Figure 5 below. It should be noted that Beni Magdoul is in Reach C and El Hammami in Reach A.

Government operated and maintained canals take water near the farmers' fields; private ditches operated by groups of farmers take the water the rest of the way to the fields. Only a small part of the land, perhaps ten percent, can be irrigated by gravity; most of it

| 12.460 | Reach B | 16.274 | Reach C | 28.545 | Reach A | 37.000 |
|---|---|---|---|---|---|---|
| "ON" | 4 days | | 2 days/part | | | |
| | | | continuous | | 2 days/part<br>4 days/total | |
| "OFF" | 8 days | | no days | | 2 days/part<br>6 days/total | |

Figure 5. Rotation Schedule in Mansouria Study Area.

requires a lift of less than one meter. Most lifting to field elevation is by sakia (wheel), but many farmers use the tambour (archimedes screw). A few use a mechanical pump, and occasionally the shadoof (counter-balanced pole and bucket) is used for higher lift distances. A few farmers take water from their own wells of from canals or drains by pumps.

A network of second and third class surface drains serves the whole area. The drainage water goes into the El Mohiet Drain (see Figure 4). In addition, the overflow of irrigation water from the canals escapes to this drain.

On-farm Irrigation and Drainage: On-farm irrigation practices in Mansouria district combine two control methods: basins and furrows. Basins are of different sizes, varying between 3 x 6m and 8 x 14m. They do not usually have a common zero level due to inadequate land leveling facilities. In addition, each basin may have a slightly different level. The furrows are built in the basins, thus they have relatively short lengths. A typical on-farm layout is shown in Figure 6.

Furrows are generally non-uniform and may be classified into two types: (1) narrow furrows, widths between 20 and 40 cm, usually used for main crops such as corn, and (2) wide furrows, widths between 60 and 80 cm, usually used for vegetables. The furrow heights range from 12 to 15 cm. The dikes, which divide the farm into basins are not necessarily high enough to prevent irrigation water from overtopping and causing damage to nearby basins and fields where irrigation is not needed.

The head ditch is always fixed at the edge of a field; however, internal field ditches vary from one crop rotation to another due to farm plowing for the next crop. Farm owners, though sharing one meska, do not plan an irrigation schedule among themselves. Also, it was observed that a fixed irrigation interval is adopted by each farmer. This interval is not varied to correspond with variations in types of crops and stages of growth, climatic conditions, nor working periods.

Farmers' replies to our inquiry regarding "when to irrigate" can be summarized in three points: (1) personal experience and judgment, (2) appearance of surface land cracks, or (3) change of color in the plant. However, in explaining "when to end" irrigation, the farmers agree that they stop irrigation when the water covers the farms to about 5 cm depth.

The farms in the Mansouria district suffer poor drainage conditions due to two predominant factors: (1) most of the lands are not served by field drains, and (2) since field drains are maintained privately without any government control, the drain bed levels become high and actually block water from entering the drains.

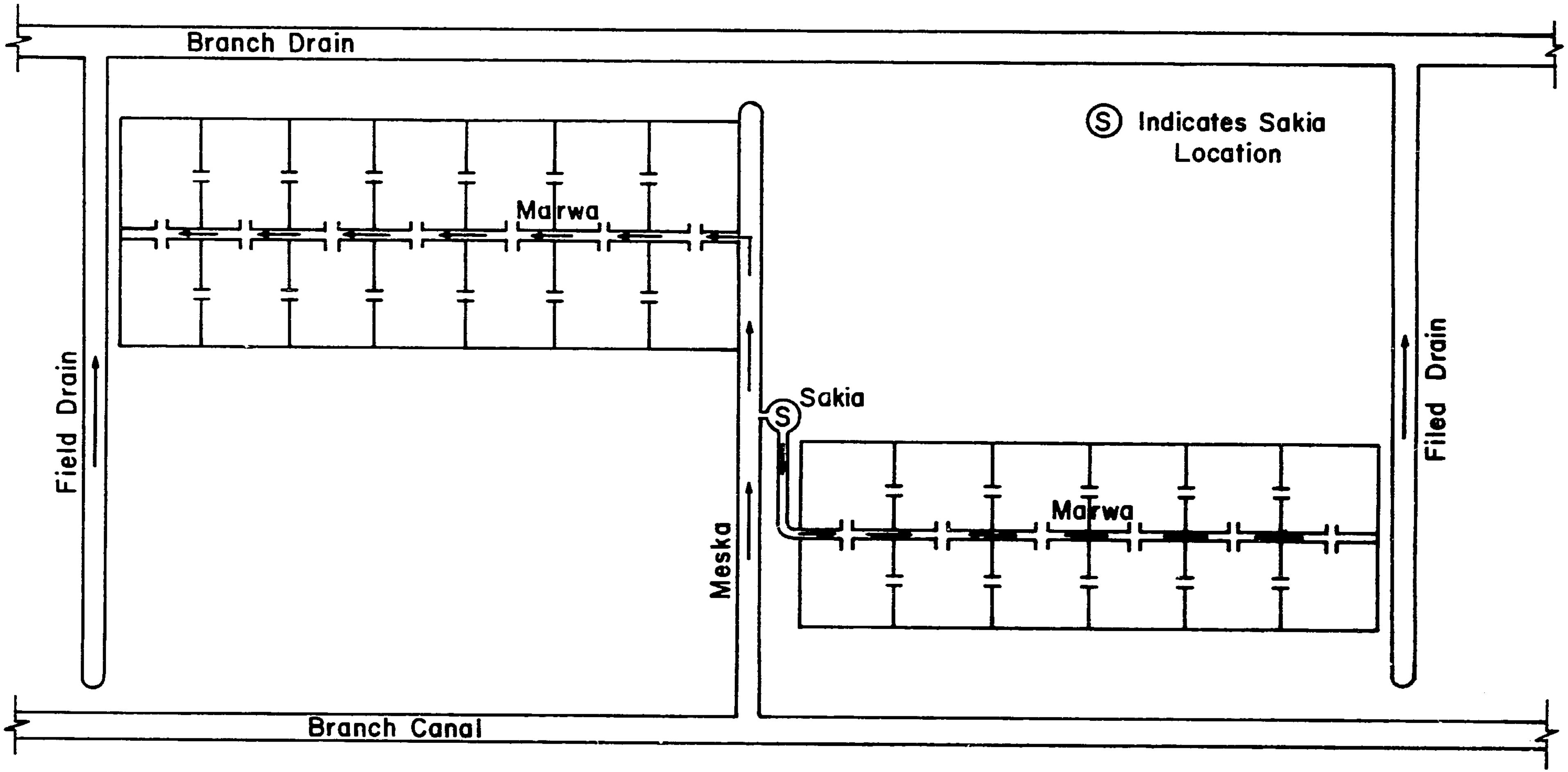


Figure 6. Typical layout of farms using basin irrigation system in Mansouria District.

Current Water Resources Policy: The water policy is intended to ensure the most efficient use possible of the available water resources and to increase the agricultural base and its production in the following ways:

1. Increase efficient use of the water resources by controlling and developing the application system and by limiting flow to the real requirement of the crop.
2. Increase crop production through a developed on-farm water management program.
3. Limit the flow to the removal system by recirculating part of its water to the application system thereby increasing the water use efficiency.
4. Control the water use and alleviate soil waterlogging problems due to excessive seepage from the system and from the excessive irrigation by generally requiring the lifting of irrigation water at the farm level.
5. Evaluate the existing ground water aquifers and use ground water as an additional water resource.
6. Insure better drainage conditions by developing the field tile drainage system.

Economic Features

Macro economic data for the two project study areas in Mansouria are not available. From observation, however, the domination of agriculture as the major economic component of both areas is apparent. It should be kept in mind that people living in both areas can commute to Cairo and have easy access to jobs in industry and commerce. In addition there are some cottage industries, e.g., rug weaving and dress making which provide some non-farm employment opportunities to farm families. As a result there appears to be little unemployment in the study area and the opportunity cost of using farm family labor on the farm is relatively high. About one-third of the farms studied show off-farm family earning for the 1978 agricultural year.

Farm families at Beni Magdoul and El Hammami have access, via oiled road, to the markets of Cairo. The distance to major produce markets is less than 10 km for both areas.

Complexity of farm management decision making in the study area arises as a result of large numbers of reasonably competitive crop alternatives. Farmers experience wide fluctuations in market prices from one year to the next as they attempt to choose profit maximizing cropping systems. Substantial opportunity exists for agricultural production and marketing research and related extension programs to help farmers choose optimal cropping patterns and marketing strategies.

## Socio-Cultural Characteristics

The social organization of village life and work patterns appears quite informal and relatively underdeveloped in the villages linked with the two Mansouria study areas. Family and friendship relations seem the pervasive force in indigenous social organization and in existing cooperative coordination patterns. Government services provided by national policy are present and formally organized, of course, but are only functionally viable and integrated into village problem-solving processes when they correspond operationally to informal preferences and social patterns. The personalities and social standing of local functionaries appears a major factor in the services qualifying for popular legitmacy and effectiveness. Generally, one is impressed with the autonomy evidenced within and among village families, and similarly, with the very limited voluntary organization of activities between relatives and neighbors.

In this regard, one suspects that what is referred to in the social science literature as "atomization" and "massification" of village life is taking place in the Mansouria District (that is the tendency for people to go their own separate ways, seeking personal gratification, not wanting to be a "bother" to neighbors or relatives and not interfering in these other people's personal affairs--similar to what often happens in Western nations when undirected suburbanization is in process). This condition has the consequences of depriving residents of a strong sense of community as well as the major social means for acquiring it and managing family and village challenges as well. If this is an accurate impression, it has both adverse consequences and affords some opportunities for the project's field development efforts.

These general impressions of levels of community organization seem to apply to each of the villages in the two Mansouria study areas, but are less apparent in Kafr Hackim, the place of residence for El Hammami study site farmers, than in the Beni Magdoul area villages which are closer to Cairo. The effectiveness of formally organized services likewise seems greater, overall, in the village of El Hammami area farmers.

## Cultural Patterns and Values

Turning attention to cultural patterns and values, the early evidence suggests the villages of the study areas are in transition from traditional Egyptian village forms to those more typical of urban centers of nations that have experienced partial modernization. More specifically, many traditional values and behaviors are evident, but exist alongside non-traditional ones, with individuals often shifting cultural modes as they sense circumstances dictate. Generally, it seems the more routine and/or mundane a task is, the more it will follow the traditional pattern, at least superficially. Women are regularly seen wearing traditional outer dresses, carrying loads on their heads or washing dishes with sand on the banks of water courses. Donkeys are ridden to fields being worked, but a truck or taxi will often take the same farmer to a nearby wedding celebration. Recurrent farm tasks like weed control or vegetable harvesting will be done by traditional hand methods, but initial plowing or infrequent applications of insecticides will often be by mechanical means.

A few cultural patterns deserve specific mention, particularly regarding collective values. The residents of the study areas cannot properly be called "folk" or "peasant" people in their life-orientations. They do not display much evidence of agrarian fatalism, although they do often indicate they feel rather powerless to control their destinies in sectors of government policy or regulation. They appear to be contemporary Egyptians in their leisure and recreational pursuits. They are religious (overwhelmingly Moslem in the study villages) and family-oriented people, but they do not seem adverse to accommodating occasional revisions in the practice of either.

In fact, they seem to be as receptive to innovations and changes as urban Egyptians--perhaps more so--when money permits and circumstances justify. Economic and material incentives seem to work well as motivating factors, as do immediate social expectations. In these regards they are atypical of what the social science literature labels "traditional" types. There seem no noticable differences between villages of the study areas with reference to such cultural patterns as these.

Attitudes Toward Assistance

A final matter of socio-cultural relevance deserves consideration in summary. Farmers throughout much of the developed and developing world have a strong desire for independence in thought and action, but also for government support in their agrarian activities. Egyptian farmers are no exception. Perhaps it is this orientation that keeps them on the land despite rigorous labor demands and modest incomes. Whatever the case, farmers in the study areas appear to dislike any exercise of governmental authority, but do look to government agencies for a range of support services. One might hastily conclude that they will not be pleased whatever is done to or for them. Experience in other cultural settings, however, has shown that modest amounts of human consideration, particularly on symbolically significant matters, will yield disproportionate concession from farmers. It is basically a matter of reciprocal responsiveness, which farmers in the study areas seem to evidence at least as much as those in other places.

Case Study Sites

As indicated previously, a small sample of farm operations in the Beni Magdoul and El Hammami study areas were chosen for in depth problem identification research. These sites include seven sites operated by ten farmers in the Beni Magdoul area, and seven sites operated by twelve farmers in the El Hammami area. The location of these sites was shown in Figure 4.

Because most of the problem identification study and analysis is based on our investigation of these case study units, some of their characteristics are summarized in the following graphs, Figure 7.

## PROBLEMS IDENTIFIED

### Introduction

With the objective of improving existing management practices of irrigated agriculture in Egypt in mind, the problem identification work proceeded as outlined above for the Mansouria irrigation district sites. A summary of the problems identified are presented below in qualitative form. Supporting quantitative data and detailed findings will appear in subsequent reports pertaining to individual disciplines.

Research results vary in some specific details in each of the two specific sites, Beni Magdoul and El Hammami; however, the results presented in this section deal with those identified problems common to all the areas. It is felt by the EWUP staff that these are major problems confronting the farmers in the Mansouria area. The problems outlined herein are clearly defined at this point; other possibly significant ones are being further investigated.

### Social and Economic Problems

Social Problems: The social problems in Egyptian agriculture relate both to the farm level organization of agriculture and to national policy and controls:

1. Social Organization Among Farmers. Presently in the Mansouria District there is a virtual absence of formal, voluntary organization among farmers on contiguous lands, and at the village level. Standing cooperative relationships, on a large scale, are not

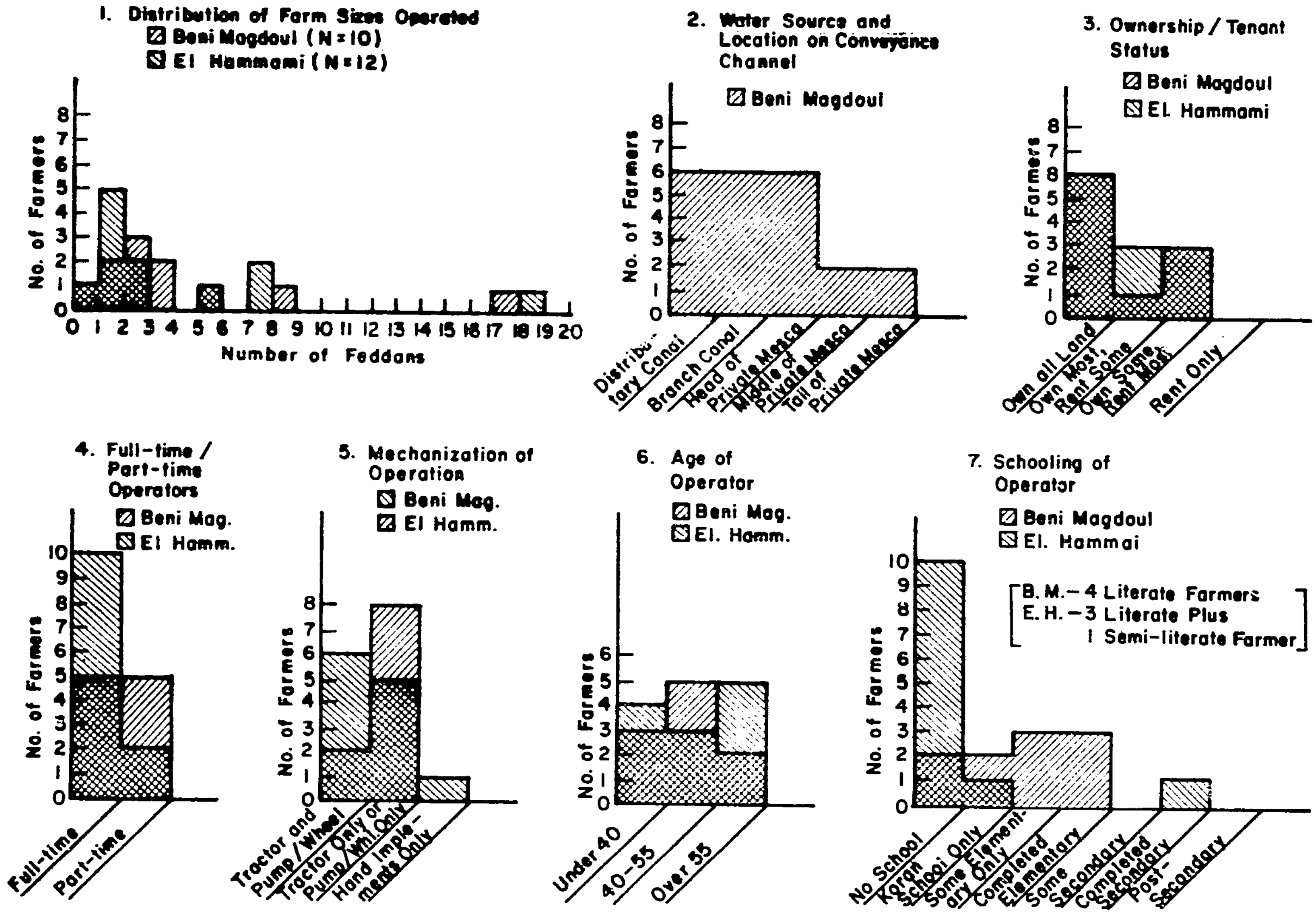


Figure 7. Some comparative farm statistics for Beni Magdoul and El Hammami.

evident. Unquestionably, the project will have to give emphasis to assisting farmers to form voluntary mutual-aid associations, perhaps along the lines of U.S. local water-users associations, but probably broader in function here.

2. Problematic Communications. There exist various problems with inadequate and inaccurate communications among neighboring farmers and with government officials. This situation leads to ineffective decision-making by farmers. It also underlies much of the suspicion and distrust evident between farmers and toward government officials and technical specialists. Such conditions are counter-productive to development processes. Accordingly, improving the frequency and quality of information flow must be implemented as a part of project activities.

3. Low Mutual Understanding and Respect Between Farmers and Official Technical Personnel. Common perceptions of problems, shared knowledge, consistent definitions of abilities, and so forth, are now not an apparent feature of relations between farmers and the government officials nor the technical experts with whom farmers have contact. Such has obviously deleterious consequences for rural development activities which depend upon close working cooperation and trust between these parties to agricultural improvement.

4. Tendency Toward Simple Technical Solutions When More Appropriate, Enduring and Efficient Alternatives Exist. Many examples could be offered; one related to project activities should serve this purpose. Presently there is a tendency to assume that less irrigation water will be applied to fields if the farmer must "work harder" to lift the water a greater distance to field level and if amounts of water supplied are curtailed. Thus, control structures are built and

the levels of ditches are lowered. Hardship is imposed on all farmers but particularly on those at the last reaches of watercourses who, even now, often do not receive the water they need at appropriate times. Demanding more effort from the farmer takes him away from other priority alternative activities which contribute to increased agriculture production. He may even be forced to make heavy expenditures for alternative irrigation methods such as pumps.

If the farmer perceives the crop needs water, observations indicate he will lift the amount of water he thinks is required regardless of the effort. From his knowledge base it is better to over-irrigate, even if it costs him in time and effort, than risk poor yields or loss of crop from not applying enough water.

Education about topics such as efficient water management, farmer-policed local agreements about appropriate water application, scheduling of irrigations, are far more appropriate solutions to the problem of excessive applications of irrigation water, both from the standpoint of the small farmer and for the nation as a whole.

5. Small-Sized Land Holding and Fragmentation of Plots. In addition to problems noted by others of poor economies of scale and difficulties of using many implements and procedures which would improve farming practices, there are socio-political implications. Some of these fall under the general heading of complicating organizational processes and cooperative arrangements among farmers. Others under divided loyalties and commitments, and still others under impeded rationality.

<u>Economic Problems:</u> The economic team presented three problems for consideration in developing EWUP plans:

1. Excessive Costs of Lifting Water. Most farmers in Mansouria lift water with sakias and tambours. Lifting water with a tambour costs three times more than with a diesel or electric pump; a sakia about two times more. Gravity distribution systems should, in some areas, eliminate lifting costs completely. However, one should recognize that changing the present canal systems to a complete gravity system could entail considerable cost in construction of barrages, new canal system, etc. The analysis here deals only with small scale lifting on a meska basis.

The determination of water lifting costs is based on the assumption that human and animal labor has a market value. Our studies indicate that human labor has a value of not less than L.E. 0.15 per hour at Mansouria even during seasons of low labor demand. The market rate for animals is about L.E. 0.32 per hour for turning a medium sized sakia. We assume further that the opportunity cost of power on farms supplying their own labor and animals closely approximates the market rate at the margin.

2. Excessive Slack Time in Crop Rotation. The average slack time in crop rotations for the study farms at Mansouria was 16 percent (58 days per year) for the agricultural years 1977 and 1978. It is our judgment that this can be reduced by better farm planning, cooperation on more capital intensive land preparation methods and improved water distribution systems (some land was idle because water was not available in the meskas).

3. Lack of Data for Farm Planning. Farmers lack the data needed for farm planning and management. They have no farm records and must recall past performance of input-output relationships from memory. Furthermore they have almost no access to secondary sources of input-output information. Substantial increases in productivity and net farm

income could result if farmers were (1) given assistance in establishing record systems, (2) provided access to secondary input-output data, and (3) helped to utilize this information in systematic budgeting and farm planning.

Agronomic and Engineering Problems

The technical problems detailed include both agronomic and engineering concerns. Some of these are overlapping; however, in this section they will be presented separately as this was the mode of their investigation.

Agronomic Problems: The agronomic team identified three problems which are limiting agricultural production in the Mansouria area:

1. Crops Stand Population. The number of plants per unit area of land is low as percent of optimum number of plants per feddan. Table 2 shows the optimum number of plants per feddan for many of the major field crops grown in the Mansouria area. Table 3 summarizes the percent of the optimum stands found on the on-farm work sites in El Hammami and Beni Magdoul. In the case of corn, stands were from 24 to 49 percent below optimum. Beni Magdoul had better stands of corn than did El Hammami farms. However, considerable improvement in both areas can be made. One factor that may explain why stands are better in Beni Magdoul than stands in El Hammami are the differences in soil. The soils in El Hammami being sandy and coarse have a lower water holding capacity and also have higher bulk density values.

2. Fluctuating Ground Water Table. High ground water levels affect crop growth by affecting soil aeration and the crop rooting zone. High crop yields can be obtained under high water table conditions providing there is a low level of salinity in the ground water

Table 2. Optimum Number of Plants per Feddan for Some Field Crops Grown in Egypt.

| | | |
|---|---|---|
| Wheat | 600 fertile heads per $m^2$<br>if plant has 6 tillers - $\frac{600}{6}$ = 100 plants $m^2$<br>4200 ($m^2$/feddan) x 100 = 420,000 plants per feddan | |
| Cotton | 60,000 plants per feddan | |
| Corn | 24,000 plants per feddan (10 rows in 7.10 m and 25 cm between plants within plants in a row) | |
| Rice | 33,000 hills per feddan and 3 plants per hill which totals 99,000 plants per feddan | |
| Berseem | 1st cut | 5 - 6 tons/feddan on green weight basis |
| | 2nd cut | 7 - 8 tons/feddan on green weight basis |
| | 3rd cut | 9 -10 tons/feddan on green weight basis |
| | 4th cut | 5 - 6 tons/feddan on green weight basis |
| Vegetables | Squash | 4,000 plants per feddan |
| | Cucumber | 3,000 plants per feddan |
| | Watermelon | 2,000 plants per feddan |
| | Pepper | 12,000 plants per feddan |
| | Eggplant | 10,000 plants per feddan |
| | Tomato | 10,000 plants per feddan |
| Oilcrops | Peanuts | 16,000 plants per feddan |
| | Sunflower | 13,000 plants per feddan |

Table 3. Percent of Optimum Plants Per Feddan.

| Site | Corn | Eggplant | Tomato | Corn + Other Crops* | Pepper |
|---|---|---|---|---|---|
| El Hammami | 51.4 | 73.3 | -- | 62.2 | -- |
| Beni Magdoul | 75.5 | -- | 84.0 | 79.8 | 128.0 |

*Other crops tomato, okra, jew's mallow, cucumber, eggplant and sunflower.

and that the level of ground water does not fluctuate during the growing season. In the Mansouria area the ground water quality is good but the level fluctuates markedly. Ground water depths on the on-farm work sites in El Hammami and Beni Magdoul were measured during the months of June and July. The data are summarized in Table 4.

Table 4. Ground Water Depth Before and After Irrigation Average Depths of Water Table Below the Soil Surface Before and After Irrigation - cm

| Location | Before Irrigation | Range of Depth Values |
|---|---|---|
| El Hammami | 69.6 | 55-90 |
| Beni Magdoul | 79.8 | 46-105 |
| | After Irrigation | |
| El Hammami | 58.1 | 54-65 |
| Beni Magdoul | 70.0 | 43-104 |

The distribution of water table depths below the soil surface are shown in Figure 8 for Beni Magdoul and El Hammami. In the El Hammami area, the water table is closer to the soil surface on an average than for the Beni Magdoul area. However, the soil texture is significantly different for the two areas as shown in Figure 9. The El Hammami area is characterized by coarse sandy soils while in Beni Magdoul the soils are sandy and clayey loams. Even though the Beni Magdoul area has a water table lower than El Hammami, the potential hazard of a high water table there may be even greater than in El Hammami because of the fine soil texture.

3. Soil Salinity and Sodicity. Soil survey and classification pointed out that salinity is a problem or could be a potential problem

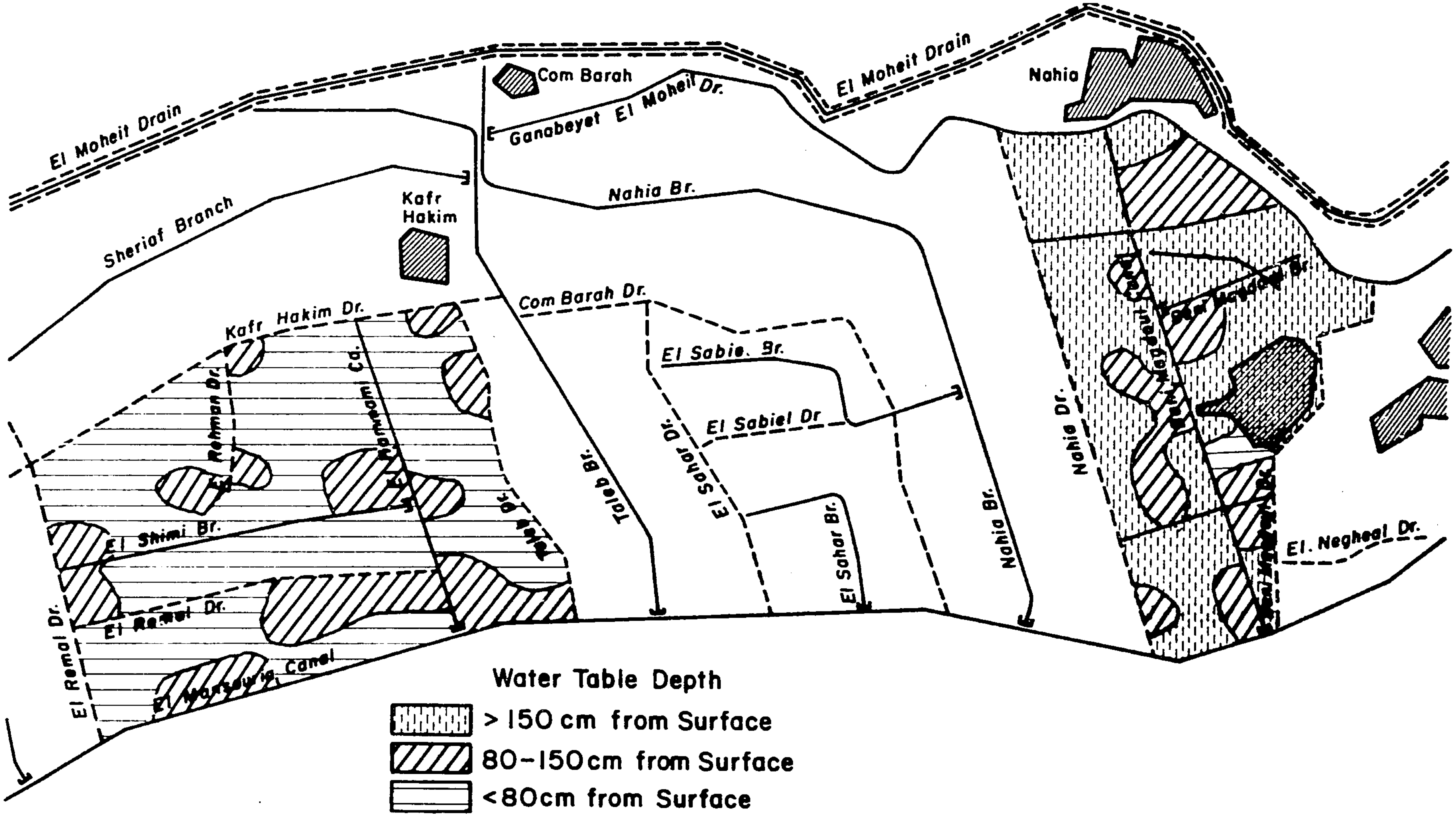


Figure 8. Water table depths below the soil surface in the vicinity of the Beni Magdoul and El Hammami water courses.

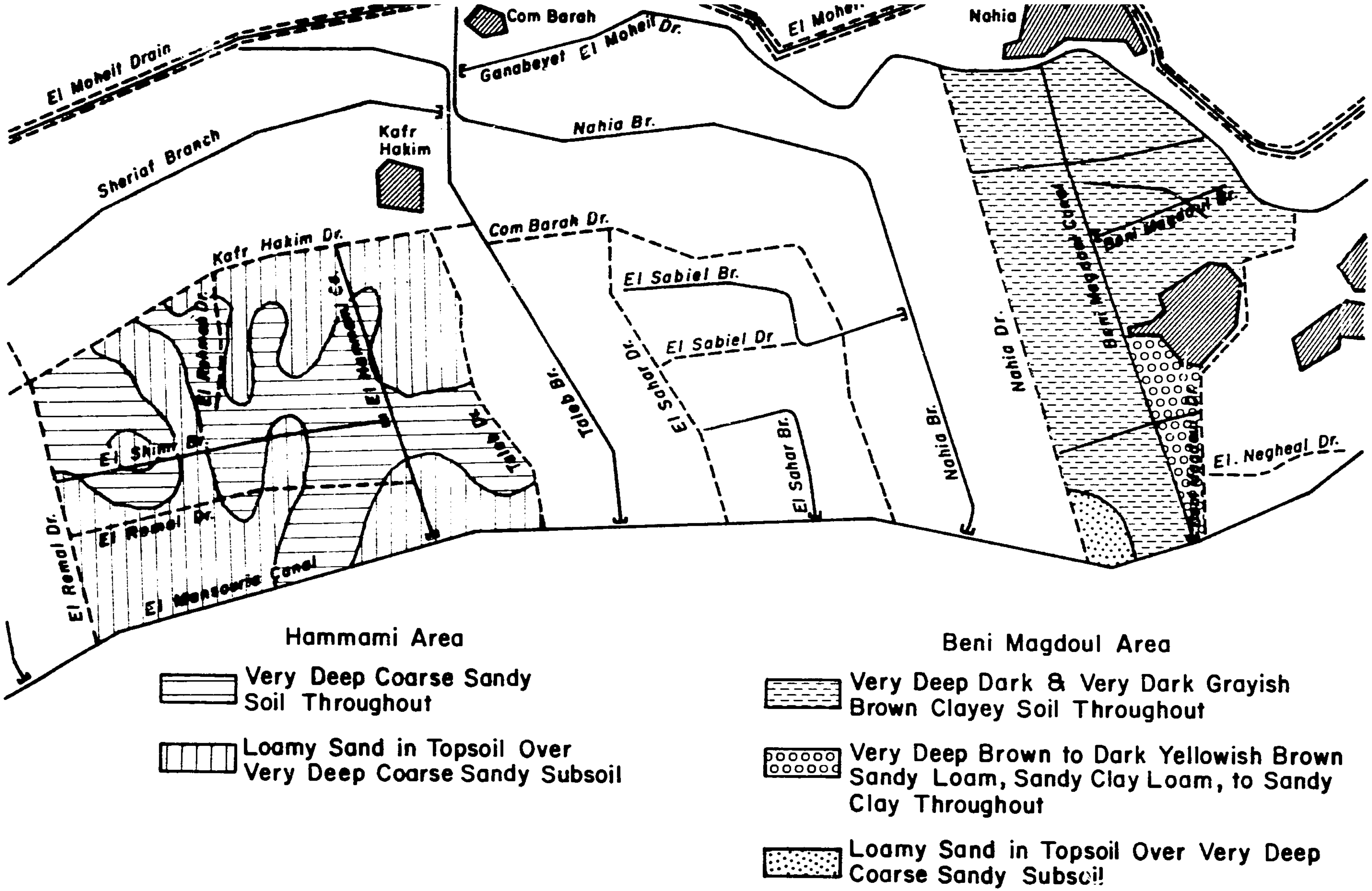


Figure 9. Soil map of Mansouria Project Area.

on 25 percent of the land area in Beni Magdoul and on 17 percent in El Hammami. Soil sodicity as measured by SAR shows that 9 percent of the area in Beni Magdoul and 23 percent in El Hammami pose potential problems if present management practices continue. The extent of the various areas affected in salinity and sodicity is shown in Figures 10 and 11 for these two water courses.

Engineering Problems: The problems identified by the engineering team deal with both the delivery system and on-farm use of irrigation water:

1. Unequal Irrigation Water Distribution Canals. Irrigation water delivered by the Mansouria canal system is not distributed equally among all the lands it serves. The problem is illustrated in Figure 12 where accumulated discharge is plotted as a function of time for the main canal and several of its laterals. Water available per feddan decreases with increasing distance from the intake of a canal or branch. As a result some land receives more water than it needs, while some gets an insufficient amount. Identified reasons include:

a. Extra (illegal) pipe intakes to private ditches have been constructed. Those near the canal intake can rob water from legitimate pipe inlets further down the canal. In El Hammami there are three times as many illegal as legal intakes. The other regions have only a few less.

b. A severe problem of submerged weeds occurred in the concrete-lined Beni Magdoul canal, during the spring and early summer 1978. Apparently the weeds were nourished by an accumulation up to 20 cm of silt in the canal. El Hammami canal was also affected, but it had a severe infestation of emerged weeds as well. Two cleanings

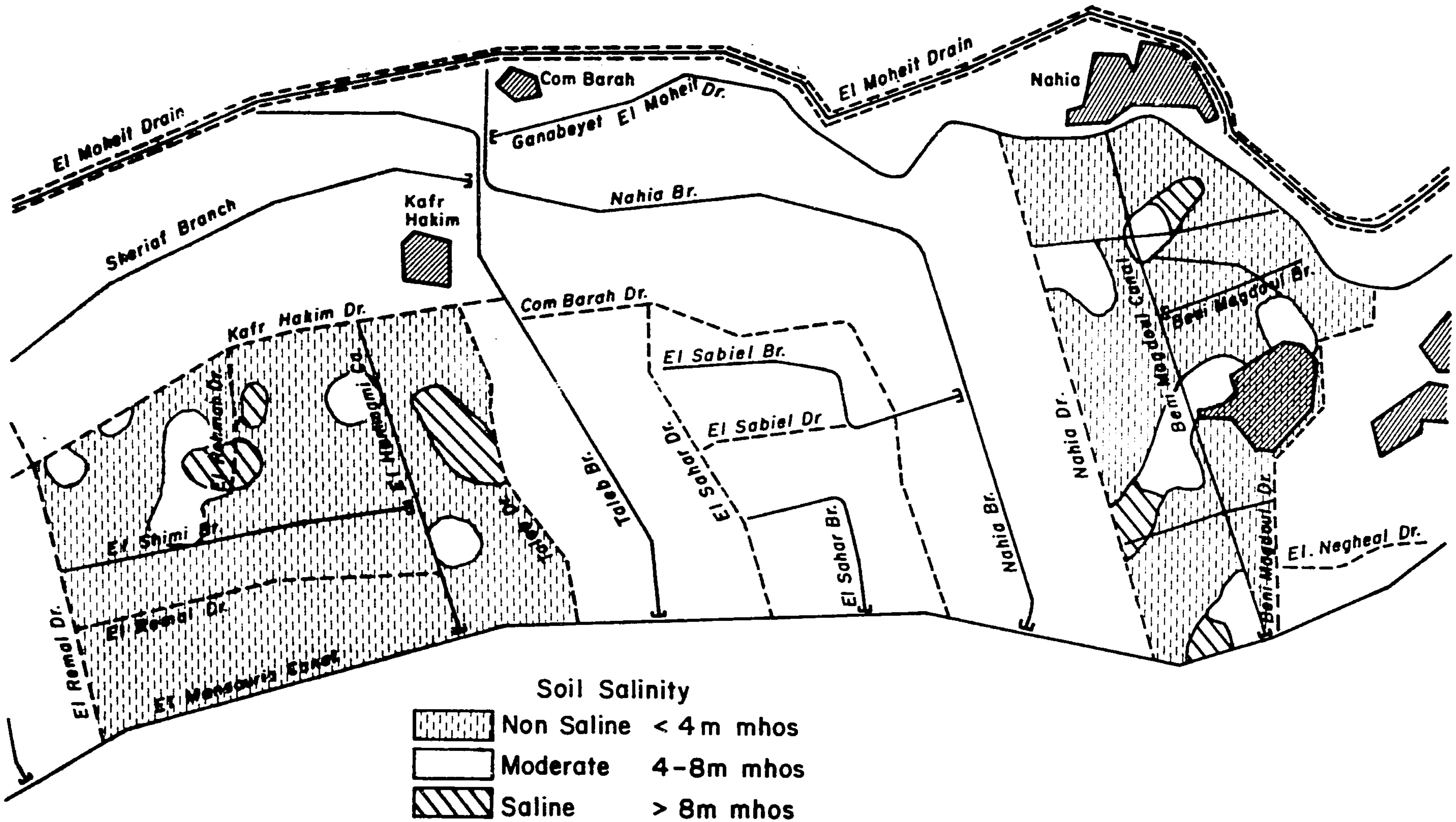


Figure 10. Areas affected by salinity.

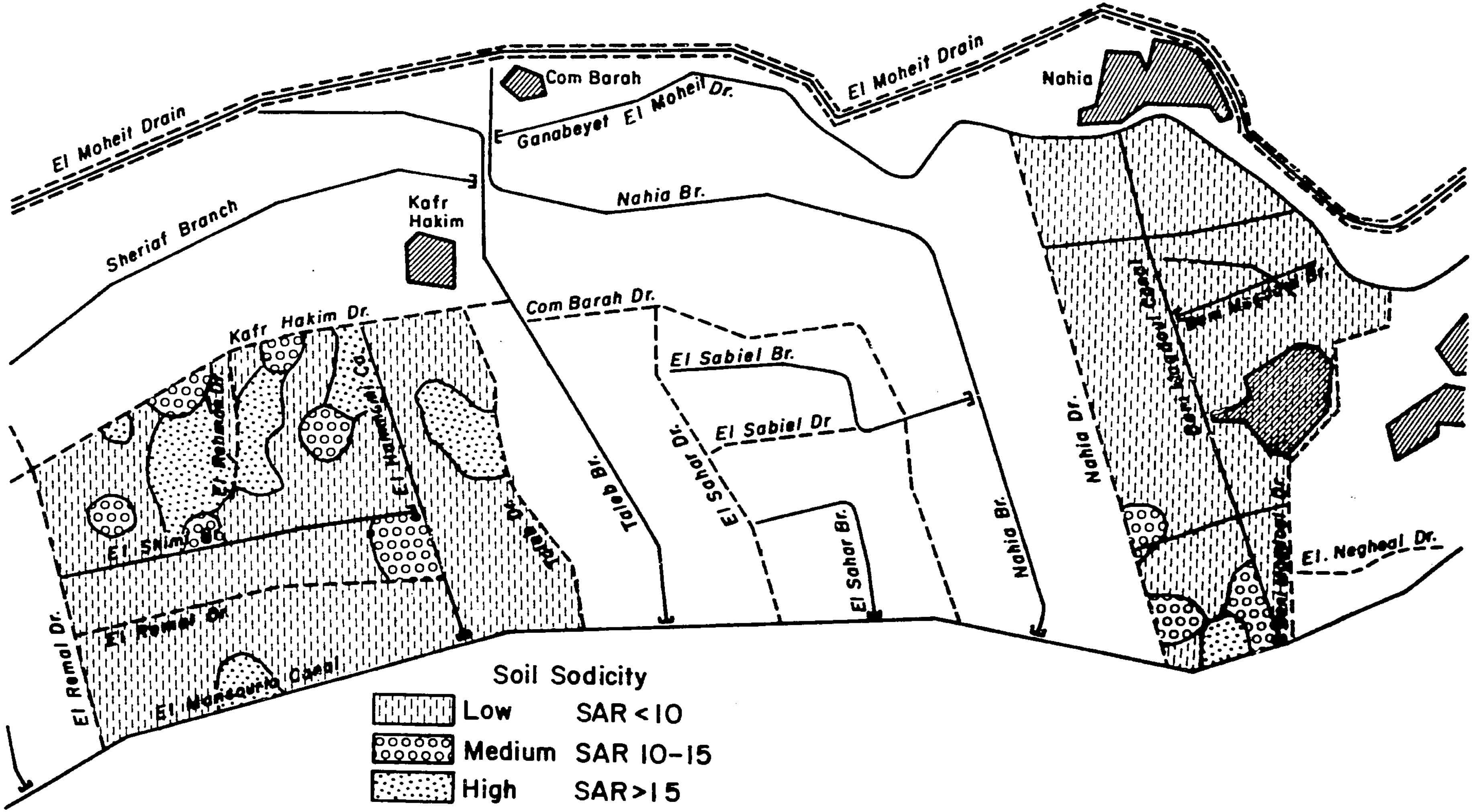


Figure 11. Areas affected with soil sodicity.

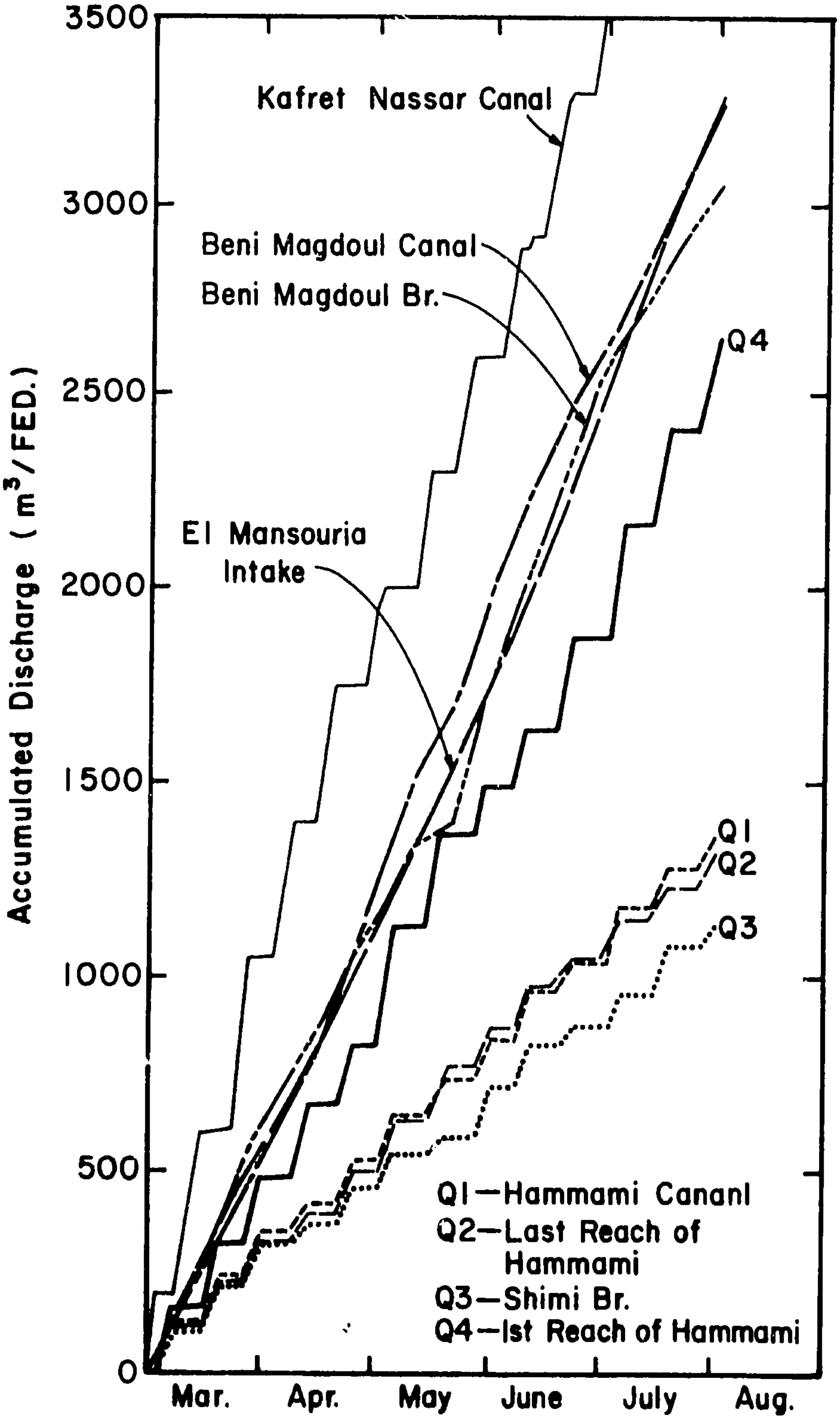


Figure 12. Accumulated discharge as measured at the upstream head gates for the Mansouria Canal and three of its laterals as a function of time for 1978.

were required in each canal during the spring and summer. Prior to cleaning, irrigations were delayed for lack of water.

c. Water delivery to a canal or to a private ditch is not usually measured, but is controlled only by the head at the inlet. Consequently, the users on a branch canal can get more by using more because the gradient is increased. On the other hand, they get less when weeds choke the canal.

d. Those users near the canal intakes, who have more water available, are less inclined to irrigate at night. Consequently, water is more likely to spill over the tail escapes of the first branch canals, due to the diurnal fluctuations, than it is over the last or lower branches. The result is less total water remaining for delivery to the last branches.

2. Uneven Water Distribution in Fields. Irrigation water is often not evenly distributed over a field. High spots and low spots appear as water infiltrates after an irrigation of a basin. One observed consequence is a poor stand in the low spots due to prolonged ponding. A high spot could suffer from too little water absorbed, especially if the low spot receives no excess.

3. Excessive Water Table Fluctuation. The average water table in Beni Magdoul rose to within 0.72 m, 0.80 m, and 0.76 m from the soil surface, respectively, at different times during the spring and summer. Just before the canal closure in January it was observed at only 0.5 m below the ground surface. In an individual field, it usually rises sharply with each irrigation, reaching a level higher than the average, such as 0.37, 0.55, and 0.41 m below the surface in field 1, site 6, during June and July, illustrated in Figure 13. Very little sustained root activity has been observed below these points of highest rise.

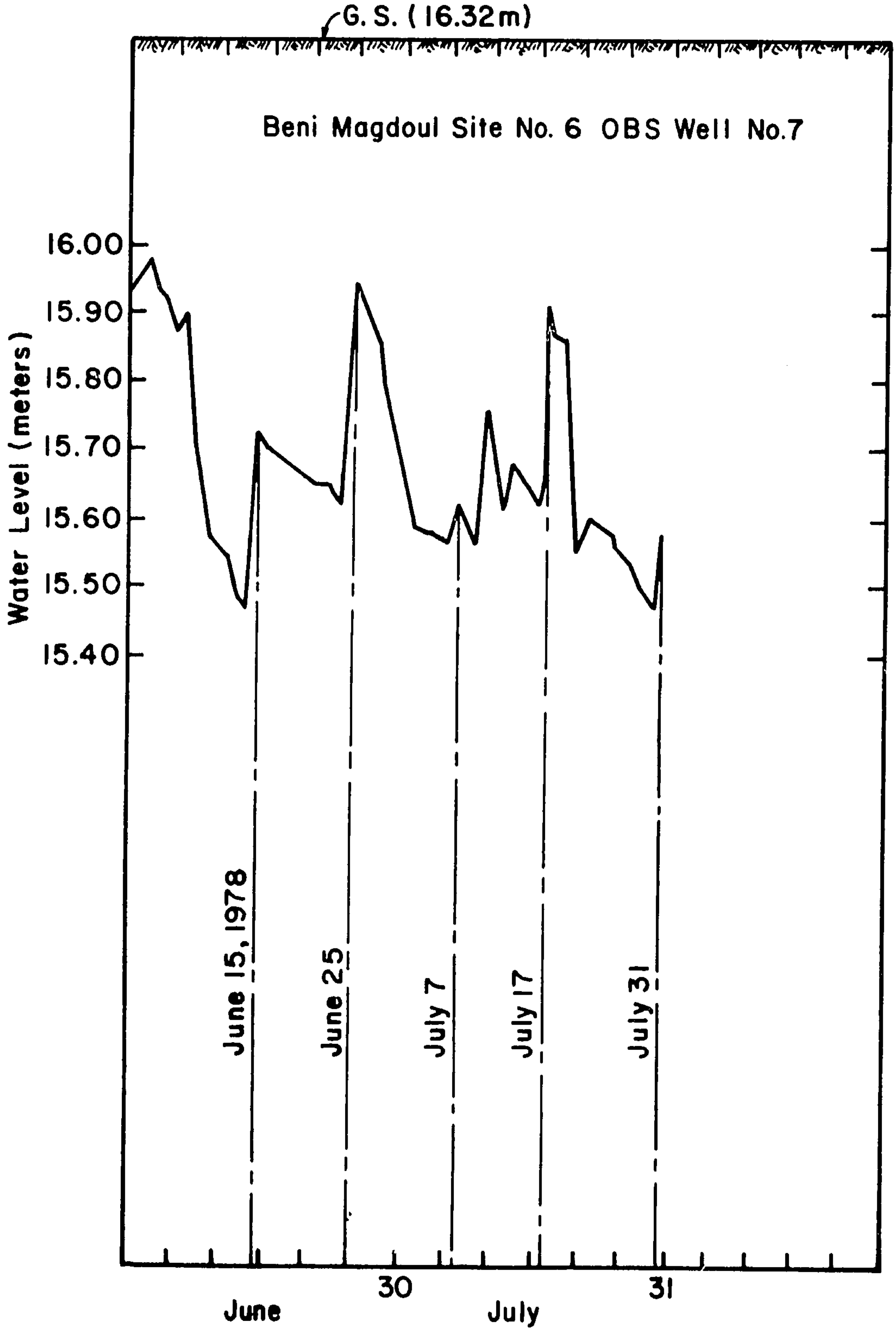


Figure 13. Changes in water elevation with irrigation.

a. Water table fluctuations may result from canal and ditch seepage. Preliminary seepage measurements show considerable variation with location and with depth of water in the ditch or canal.

b. Irrigation applications which exceed the soil moisture deficit contribute to the water table. These are most likely to occur (1) at planting, (2) during a deliberate leaching irrigation, or (3) when two irrigations are applied during "on" period of the rotation. A particular irrigation at another time might also be excessive, but they tend to be much closer to the actual soil moisture deficiency.

4. Irrigation Water Quality. Although water quality in the canals is good (C-2, S-2 by U.S. Salinity Lab classification), salt has accumulated on the ground surface in small areas, due at least in part to a water table close to the surface at those points. Water in drains may have two or three times as much salt (maximum classification C-3, S-3, moderately high), and therefore more restrictions are required when using it for irrigation. Water from wells classifies between these extremes.

5. Land Used for Water Conveyance. The sizeable land area (about 12 percent) occupied by farm ditches is not available for crop production.

6. Seepage Losses. Seepage loss from canals and ditches necessitates designing these structures with larger cross sections. For at least that portion of this water that is pumped back from drains the head is also lost.

7. Weed Growth. Weed growth in drains is sometimes permitted to interfere with the intended performance of the drains.

8. Animal Crossings. Where animals cross canals and drains they tend to break down the banks and raise the bottom.

Interdisciplinary Research

Once the data for the above disciplinary problems were reported and an attempt was made to structure it into a coherent interdisciplinary theme, it became apparent that there were gaps in the data which could best be filled in by an interdisciplinary group. These groups have now been established and research on the following questions is proceeding:

1. Excessive costs of pumping/alternative pumping methods.
2. Crops stand densities.
3. Effect of high, fluctuating water on agricultural productivity and with contribution to crop water requirements.

The problems of excessive pumping costs and poor crop stands were also selected as the areas in which the most gain could be made for small farmers in the next phase of project activities in Mansouria. During the next research phase, field trials will be undertaken. If the field trial results are positive, the proposed alternative solution will be extended throughout the Mansouria area and to other areas in Egypt where similar problems exist.

## SUMMARY AND CONCLUSIONS

This report summarizes the activities of the Egypt Water Use and Management Project over approximately the first year of operation. The first expatriates arrived on the project in October 1977. This report represents the status of the project as of October 1978 with particular emphasis on that accomplished in the Mansouria Irrigation district.

The problems identified below seem to be those with solutions which would benefit the farmers the most.

Most farmers in the Mansouria irrigation district lift water with sakias and tambours. An analysis of lifting costs using tambours and sakias has led to the conclusion that one electric or diesel pump located on a Meska serving 50-60 feddans may reduce the lifting costs by one-third. Reducing lifting costs by reducing the number of lifts is relatively easy to accomplish technically and physically. However, this kind of solution requires that the farmers cooperate together and schedule irrigation water. Due to the wide variety of crops, size of farms, and differences in farming habits of individual farmers, reducing the cost of lifting water by reducing the number of lifts which much bring about scheduling will not be particularly easy. For instance, the farmers are not particularly interested in mechanical devices that may require maintenance as in the case of the diesel pump or in the case of an electric pump, a power failure, where they may run the risk of losing some productivity because of the failure of the mechanical system. In addition, they do not feel particularly confident that coöperation can be achieved between so many farm operators. In the Mansouria irrigation district where farm size is relatively small, and where one Meska may serve 30-40 individual farmers, it is not difficult to appreciate their concern.

A second problem appears to be the excessive amount of time that the land is out of production. The average slack time for crop rotations for the study farms at Mansouria was 16 percent for the agriculture year 1977-78. This amount of slack time represents about 58 days per year and it appears that this time could be reduced substantially to increase net-farm income. The reasons for this excessive slack time in crop rotations are not particularly clear. However, interviews with several farmers indicate that for some crops the land must be plowed and exposed to the air and sunshine for a significant period of time before it can be returned into production. Some of these ideas about having the land rest between crops may be a carryover from the annual basin type irrigation used before the Aswan High Dam. Other reasons for slack time may very well be due to inefficient farm operations, e.g., being unable to obtain seeds or equipment for planting or manipulating the soils at the proper time.

Substantial increases in productivity and net farm income also could result if farmers were given assistance in establishing a farm record system and were helped to utilize records and farm data for systematic budgeting in farm planning. A farm planning system would allow decisions to be made in a farm operation that would bring about an opportunity for greater net income.

A few important technical problems identified in the Mansouria irrigation district include: the relatively low percentage of plants per feddan, high water table fluctuations in the plant root zone of the soil profile, and the relatively high percentage of land that may be potentially saline or sodic.

At the time of writing of this report it is not particularly clear the reasons for the low plant stand density. Some preliminary observations indicate that the distribution of water on the land at the time of irrigation and that coupled with low seed quality and hand planting techniques may be responsible for the lower than optimum number of plants per feddan.

The high water table fluctuations in the plant root zone result mostly from irrigation and seepage from Meskas and canals. It is not clear at this point how much each of these contribute to the duration and frequency of fluctuation. In the El Hammami area where the soils are relatively sandy, the water table seems to be higher than those areas in Beni Magdoul where the soil texture is more clayey and finer textured.

Another problem of considerable significance is that irrigation water delivered by the Mansouria canal system is not distributed equally among all the land it serves. Water available per feddan decreases with increasing distance from the intake of the canal or branch canal. As a result some land receives more water than it needs while some gets an insufficient amount.

Some reasons for these inequities in distribution include: illegal extra intake pipes into private ditches, conveyance head losses due to weeds, and excessive seepage in sandy areas.

Perhaps the most pressing social problems that the farmers face in Mansouria, which will have a substantial effect upon improving management practices and making appropriate changes for their well being, is a virtual absence of formal voluntary organization among farmers on contiguous lands and on the village level.

The problem of inadequate and inaccurate communication among neighboring farmers, and with governmental officials lead to ineffective decision making among farmers. Suspicion and distrust between farmers and toward government officials and technical specialists will bring about slow changes in management practices on the farm. However, there is every reason to believe that the farmers will accept change when suspicion and distrust can be eliminated by cooperative and reliable governmental operations. An example situation occurred on the Beni Magdoul branch canal and several of its Meskas when it was planned to line these with concrete. The farmers at first were completely unwilling to accept this change in their water conveyance system and vehemently objected simply because it appeared that the new conveyance cross section would reduce the quantity of flow and cause inadequate water supply for their individual needs.

After completion of construction and about six months of operation of these lined canals and Meskas, the farmers have seen the value of lining and understand that there are factors that control quantity and distribution of water other than the size of the conveyance channel. There is presently a clammering among farmers to have their particular Meskas lined. They see more dependable water distribution: lower water tables adjacent to the Meskas and increased land brought into production due to reduced seepage and reduced cross sections. They are presently ready to accept with great enthusiasm this particular management practice. There is a verv good likelihood that other types of management practices which farmers are presently unwilling to accept but when adequately demonstrated they will be acceptable to them.

With these problems identified, EWUP is proceeding to implement some field trials with respect to reducing lifting costs, increasing plant stand density, and other associated on-farm practices such as land leveling for increased water distribution efficiency. Such field trials may help the farmers see, through demonstration, those management practices that will increase production and net income to them. This is being undertaken by: working directly with farmers and their representatives, discussing their problems, offering solutions and assistance, suggesting other solutions to problems that perhaps they may not be aware of.