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# QUARTERLY REPORT

April 1, 1983 to June 30, 1983

# EGYPT WATER USE AND MANAGEMENT PROJECT

Contract No.

AID/NE-C-1351 (Egypt)
Project No. 263-017

Consortium for International Development
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# I. PROJECT STATUS IN EGYPT

A four-day workshop was held in Cairo May 30 through June 2, 1983. Project findings and tentative recommendations were presented and discussed. In addition to the entire EWUP professional staff the workshop was attended by a panel of reviewers consisting of Drs. Mahmoud Abu Zeid, Daniel K. Sunada, Ali Serry, Wayne Clyma, Willis W. Shaner, Ibrahim El-Assiouty, George Radosevich and Charles Bailey. Mr. John Foster, AID Cairo, attended.

The workshop provided an excellent review of Project activities and provided the entire staff with insights into the findings and observations of professionals from all disciplines. In follow-up meetings the results of the workshop have been discussed and plans are being made for presentations at the National Conference, tentatively scheduled for November 27-29. A copy of the agenda, list of workshop reviewers and a summary of the papers presented at the workshop are included in the appendix of this report.

Planning for an International Conference on Irrigation Water Management in Cairo continued during the past quarter. A firm decision will be made in July as to whether to proceed. Funding commitments are nearly completed. If the decision is affirmative, committees will begin working on program details. The tentative date for the conference is April 16-19, 1984.

Work at the three field sites is progressing but construction delays will make final evaluation of some irrigation interventions less complete than expected. The contractor for the El-Hammami Pipeline stopped working in May and arrangements for completing the work are now underway. This construction is being financed by the GOE. Also

contractor delays at Minya are slowing the work of *mesqa* modification for the total area of 1200 *feddans*. It is, however, anticipated that this work will be completed by the original contractor. The *mesqa* modification work at Minya is still highly promising. Farmers are presently disappointed about the delays but there is much enthusiasm for the long-run potential for improvement of the watercourse. The Kafr El-Sheikh team is moving ahead with plans for an improved distribution system for the entire Dekalt Canal command area. This is a logical extension of EWUP work into a regional improvement program.

A review of the Professional Employee Exchange Program (PEEP), operated jointly by the Ministry of Irrigation and the Salt River Project through EWUP, was conducted in May. Salt River Project personnel who visited Egypt were Marcel Boulleis, Vice president; Jack Phiester, General Manager; Jack Mason , Director of Water Research and Ed Kirdar; Research Engineer. After meetings with MDI, AID and EWUP representatives it was agreed to pursue a phase II of PEEP which would provide further experience and training for professional staff. A copy of the protocol agreement is included in the appendix.

Assistance has been extended by EWUP to the IMS Project. Numerous visits by personnel from the Project Preparation Unit of IMS have been made to EWUP for the purpose of utilizing research results in planning the North Zifta Project. EWUP has also assisted the Training and Manpower Project (IMP) of IMS with establishment of an on-farm water management training course at Kafr El-Sheikh. Twenty four young professionals from the MDI have been selected for this course which is scheduled to begin at Kafr El-Sheikh on July 23. Dr. Layton will be serving as the only American advisor to this training effort. He will spend most of July and August at Kafr El-Sheikh. The tour of irrigation facilities in the United States will be held in September under the guidance of EWUP staff at Colorado State University.

EWUP cooperated with the Egyptian Agricultural Mechanization Project (EAMP) to level 100 *feddans* of land at the Minya field site. This cooperation provided training for EAMP personnel to use the equipment which has recently been acquired by the Project under the Ministry of Agriculture. It also provided EWUP an opportunity to further develop the irrigation system for the Abyuha Canal command area.

Arbitrary application of regulations by the Egyptian Customs Department have caused continued problems. An air freight shipment containing desk calculators, paper for water level recording instruments and other equipment and supplies has been detained at the airport since March, 1982. Release of recent shipments of other equipment vitally needed to complete Project research reports, has also been held up. Meanwhile, the Customs Department charges storage for these shipments. Continued efforts are being made through USAID and the Government of Egypt to resolve this problem.

Changes in staff assignments, during the past quarter, for American personnel are as follows: (1) Dr. Erwin Nielsen returned to the United States, (2) Mr. William Braunworth returned to the United States and (3) Mr. Kenneth Litwiller moved from Kafr El-Sheikh to Cairo. These moves were effective July 1, 1983.

The presence of American advisors at the three field sites is now terminated. The resident staff in Cairo, plus TDY personnel as needed, will continue to serve the field offices on a request basis. Primary responsibility of the American staff, however, will be to complete current research and report the results before the Project terminates June 30, 1984. The leadership of teams at the field sites is now provided by well trained and experienced Egyptian personnel who have served on the EWUP staff since its beginning.

Project work is now organized among six pilot program groups and nine active task groups.

## Pilot Programs

| | |
|---|---|
| Kafr El Sheikh Site: | Manshiya *Mesqa* |
| | Hammad *Mesqa* |
| El Mansuriya Site: | El Hammami Pipeline |
| | *Mesqa* #10 Raised Channel |
| El Minya Site: | Abyuha Canal Raised Channel |
| | *Mesqa* Improvement |

### Task Group

| | | |
|---|---|---|
| TG | 1 | On-Farm Water Management |
| TG | 2 | Water Distribution Systems |
| TG | 3 | Farmer Organization |
| TG | 4 | Farm Management and Planning |
| TG | 5 | Water Budget |
| TG | 6 | Land Leveling |
| TG | 8 | Soil Characterization |
| TG | 10 | Conjunctive Use of Water |
| TG | 11 | Irrigation Advisory Service |

Task groups #7 and #9, Soil Fertility and Pest Control respectively, have completed their objectives and have been terminated.

A detailed report of each pilot program and task group follows.

## MANSURIYA

The pilot programs of Mansuriya include the elevation of *Mesqa* #10, forming a lined concrete structure and construction of a buried pipeline replacing the El-Hammami Canal.

The objectives of these structures are basically to:

1. Deliver proper quantities of water to all farmers served by the system.

2. Reduce the conveyance losses which now occur.

3. Deliver water to farmers with sufficient head to allow for faster irrigations by gravity.

4. Eliminate the need for lifting water on an individual basis by providing centralized lifting.

I. Accomplishments and Future Plans for the El-Hammami Pipeline Pilot Program are as follows:

Table 1. Construction progress of the El-Hammami pipeline to March 31, 1983.

| | Unit | Total amount to be installed | Pipes actually laid No. | % |
|---|---|---|---|---|
| Pipes with diameter 60cm | meter | 3084 | 2298 | 75 |
| Pipes with diameter 50cm | meter | 1667 | 1224 | 73 |
| Horizontal pipes, 10 cm | Unit | 768 | 176 | 23 |
| Vertical Pipes, 10 cm | Unit | --- | --- | -- |
| Elbow pipes | Unit | 64 | 8 | 12.5 |
| T Connection pipes | Unit | 64 | 30 | 47 |

1. No work is proceeding on pumphouse one and two. The pump stands are complete.

   Corner stand at the end of Shimmy Branch is complete. The gate stand is nearly complete while work is begining on the corner stand of line 1. It is complete to ground level but subsequent work has not continued.

   Approximately 30 'T' connections for alfalfa valves have been installed. However, this installation does not include the vertical pipes and alfalfa valves as yet.

   No additional pipe has been laid this quarter. Unofficial testing was done in a very limited manner on the Remaily Drain line.

   Problems continue to occur in water delivery to farmers during construction. This has had deliterious effects on EWUP-farmer relationships. Weekly meetings are being held with the contractor to push the work and to solve operational problems. Since attendance at these meetings by the contractor dwindled to nothing we are not continuing these meetings. Due to contractual disputes and other problems essentially no work has been done on the pipeline during this quarter.

2. On-farm water management data were being collected on several sites. This will continue in the next quarter. This included conveyance loss tests.

3. The farm record data are being maintained and will continue. Several new crop enterprise cost studies have been completed as well. Work is being done on farm management surveys.

4. Selected water budget and water quality data are being collected.

II. Accomplishments and Future Plans for Beni Magdul, *Mesqa #10* Pilot Programs are as follows:

1. OFWM data continues to be collected.

2. Data collection has included documentation of the farmers' irrigation schedule. This will be continued and will be used to evaluate the performance of the new *mesqa*. Data regarding *mesqa* #10 are being prepared for an evaluation report.

3. *Mesqa* #10 operation continues to be complex. With 4 out of 5 water sources being privately owned and operated the opportunity for exact scheduling is limited. The desire of farmers to be independent is evident, especially where the new well and pump have been installed. In addition the unreliability of the water source at the intake to *mesqa* #10 adds to the difficulty of operating the *mesqa*. The problem of the water shortage at the *Mesqa* #10 pump has been found to be critical some days and not a problem other days. This is due to many factors which include the demand on water up stream and the amount being released in the Beni Magdul Canal. At times when the demand up stream is low and there is adequate water at the *Mesqa* #10 pump site, a second pump is put into operation. Using two pumps allows for more than 70 l/s to be discharged into the *mesqa*. More farmers are able to irrigate at this time, partially compensating for water shortages at other times.

III. Special Studies:

A) The water budget work is being continued in the Beni Magdul

area. Full details are reported by the water budget task group.

B) The cropping sequence studies are continuing in both areas.

C) The farm record data on numerous sites and the farm management surveys in the Beni Magdul Canal area continue.

D) On-Farm water management measurements are continuing on *berseem* on *mesqa* #6.

III. Reports expected to be released this quarter are as follows:

1. Report on *Berseem* Irrigation and Production on *Mesqa #6*, Beni Magdul 1981/82.

2. Report on Corn Irrigation and Production on *Mesqa #6*, Beni Magdul Canal 1982.

3. Report of Basic Engineering Data and Pipeline Construction Concepts for El-Hammami Pipeline Project.

## Mansuriya Field Staff

### I. Professional

| | | | |
|---|---|---|---|
| Wadie Fahim | Team Leader | Bill Braunworth | Ass. Team Leader |
| Eldon Hanson | Eng.(Half time) | Moheb Semaika | Agr.(1/3 time) |
| Shinawy A. Atty | Economist | Mohamed Naguib | Sociologist |
| Ahmed Tahoun | Agronomist | SAbah Mahmoud | Agronomist |
| Farouk Abel Al | Sociologist | Lotfy Nasr | Economist |
| Gamal Fawzy | Economist | Mahmoud Khadr | Agronomist |
| Tarik Abdel Rahman | Agronomist | Tarif Zeitoun | Engineer |

### II. Non Professionsal

| | | | |
|---|---|---|---|
| Badry Mahmoud | S. Tech. | Hamdy El Said | S. Tech. |
| Ibrahim Hussein | S. Tech. | Gamal Ahmed | S. Tech. |
| Mervat Mohamed | Secretary | Rokaya Abdel Mawla | Secretary |
| Ibrahim Abdou | S. Tech. | El Said Kamal | S. Teck |
| Ibrahim Zakaria | S. Tech. | Moustafa Mahmoud | S. Tech. |
| Said Rezk | S. Tech. | Mohamed Abdel Hamid | S. Tech. |
| Abdalla Abdel Moneim | S. Tech. | El Said Hamed | S. Tech. |
| Ibrahim Abdel Fatta | S. Tech. | Mohamed Farrag | S. Tech. |
| Mohamed El-Dash | S. Tech. | Mohamed Shaaban | J. Tech. |
| Ismail El Shimi | J. Tech. | Abdel Rahman Eid | J. Tech. |
| Abdel Rahim Mohamed | J. Tech. | Shawky El Awady | J. Tech. Lab. |
| Abdel Maaboud Ibrahim | J. Tech. | Selim El Tantawy | J. Tech. |
| Farahat El Ashkar | J. Tech. Lab. | Fathy Abouel Nasr | J. Tech. Lab. |
| Hamed Aly Tahoun | J. Tech. Lab. | Ahmed Ragab | J. Tech. Lab. |
| El Shimi Ismail | J. Tech. Lab. | | |

### III. Drivers

| | |
|---|---|
| Abdel Latif El Tawil | Mohamed Rezk |
| Abu El Ella | Aly Habashy |
| Salah Sadek | Nagy Hassan |

## KAFR EL-SHEIKH

### I. Summary of Progress

During the second quarter of 1982, work at the Kafr El-Sheikh EWUP site focused on activities as described below:

1. Routine data collection activities were carried out on all winter season pilot program sites of wheat, sugar beets, and beans. Lifted and applied irrigation water was measured. Observation well and irrometer readings were taken. Soil moisture samples were taken before and after irrigation.

2. The Hammad wheat site with 200m long borders was irrigated by using a gated pipe and pump system. Irrigation had been delayed by three weeks due to water shortages in the Dakalt Canal system. Border dike quality had deteriorated due to soil cracking and the advancing water front was not contained within the desired borders. The advance-recession test did not yield good results so that the desired comparison between water advance for drilled vs. broadcast planting was not obtained.

3. Yield measurements were taken for all winter crops. Soil salinity samples were taken after harvest. Farmers' perceptions of the EWUP pilot program were monitored. Data analysis for the winter 82-83 season was begun.

4. Filling of the Manshiya Lake continued. About one-half of the Manshiya *Meaqa* at Manshiya Village was returned to near to design cross section.

4. Filling of the Manshiya Lake continued. About one-half of the Manshiya *Mesqa* at Manshiya Village was returned to near to design cross section.

5. A cotton site was selected at the end of Om-Sen Canal for pilot program implementation during the 1983 summer season. The site was surveyed, mapped, and a new layout was designed. The land was leveled and furrows were constructed. Water measurements were taken during irrigation. Other routine data were collected.

6. Farmers and professionals from El-Minya visited EWUP Kafr El-Sheikh on 6, 7 and 8 April. The visitors exchanged ideas with Kafr El Sheikh professionals and farmers and observed the field activities of land leveling, cotton bed making, and cultivating by donkey plow.

7. Members of the K.E.S. Team visited the El-Salheya Project to observe sprinkler and drip irrigation.

8. A 2.2 *feddan* rice site was selected, surveyed, and leveled by using EWUP farm machinery. A corn site was selected but not leveled because the winter crop of seed berseem is still in the field.

9. Routine sociological data book and contact record and economic farm records work continued. Additional work was done on the crop calendar study. Climat logical measurements were taken at Kiradi station. Filling of the Dr. Knop sociological questionnaire was begun. Information for an economic technical report was given to the main office advisor.

10. A presentation including slides about the Kafr El-Sheikh pilot program was prepared and presented at the workshop in Cairo.

The Kafr El-Sheikh team attended the workshop and participated in the discussions following each presentation.

11. Delivery system data were collected according to instructions from the main office. Sixteen *mangaa* were surveyed with cross sections taken every 100 meters and profiles and cross sections were graphed. Soil profiles, water samples, and crop surveys were taken on 2 *mangaa* from each of the 3 reaches of Dakalt Canal. Socio-economic data were collected from 5 cooperatives on Dakalt Canal for basic information concerning farmers, *maqsa* units, and cropping patterns.

12. Routine data collection was carried out for the Om-Sen water budget including water levels and quality for surface and subsurface water. A new water level recorder was installed at Gadalla Branch Drain. Meteorological data and crop surveys were taken.

## III. Training Status and Changes

1. Engineer Amany El Kayal is continuing a Master degree program at Utah State University under the Peace Fellowship Program.

2. Engineer Kamal Ezz El-Din, Agronomist Hegdy Awad, and Sociologist Ahmed El Said El-Attar returned from two semesters academic training at Colorado State University in June and rejoined the Kafr El-Sheikh EMUP Team.

## II. Personnel Activities

### 1. Professional Staff

| | | | |
|---|---|---|---|
| Abdel Fattah Metawie | Team Leader | Ken Litwiller | Ass.Team Leader |
| Kamal Ezz El-Din 5/ | Engineer | Amany El-Kayal 4/ | Engineer |
| Magdy Awad 4/ | Agronomist | Ahmed El-Attar 4/ | Sociologist |
| Ahmed Ismail | Agronomist | Safaa Fahmy | Engineer |
| Mohamed I. Meleha 1/ | Agronomist | Hoda Hussein | Agronomist |
| Magdi Badawi | Economist | Ragy Darwish | Economist |
| Sohair Kamal Youssef | Sociologist | Saad H. Zaki | Engineer |
| Mahmoud Moh. Said 3/ | Agronomist | Sobhi Elewa 4/ | Economist |

### 2. Technicians

**Hammad Group**

Moh. Ahmed Badr
Moh. Omer Abdel Meguid
Kamal Moh.Abu-Omar
Helal Moh. Hussein
Abdou Mostafa Kamel
Abdel Aziz El-Yamany(Oct.only)
Ragab Moh. Shanab (Oct.only)
Gamal Moh. Ali (Oct.&Dec.only)

**El-Manshiya Group**

El-Said Abdel Hamid
Salah El Sayed Abdel Hafeez
Ahmed Abdel Hamid(Oct.&Nov.only)
Magdy Abdel Hamid(Oct.only)
El-Said El-Said Helal (Oct.only)
Abdel Hamid A. Seif(left in Dec.)
Hamdi Abdel Hady Moh. (Oct.&Nov.only)
Mostafa Moh. Abu-Omar(Dec.only)
Salah Ahmed Badr(Dec.only)
Moheb Abdel Samad EL-Sawy

**Water Budget**

El-Said Abdel-Salam (Oct.only)
Sabri Mostafa Taha (Oct. only)
Bilal El-Said Metawie (Dec. only)
Ahmed Abdel-Hami (Nov.&Dec.only)
Ramadan Gazal

**Laboratory**

Atef Hamed Sayed
Hanaa Ali Said

**Equipment & Cars**

Alaa Fatouh Ibrahim
Abdel Hamid Sayed

### 3. Secretary & Administrative

| | |
|---|---|
| Mohamed Abu Omar | Admin. Assistant |
| Nadia Mahmoud Arafa | Secretary |

### 4. Drivers

Asel Ahmed A.Aziz
Osama Moh. Sobh
Kamal Saled Talha
Attia Mostafa Abdu
(tractor)

### 5. Laborers

Saber Ahmed Ismail
Ibrahim Gaid Ahmed
Abdel Raouf Mazal
Mohamed Mostafa Omar
Osman Abdel Rasoul
Ahmed Mostafa Baraka
Ibrahim Moh. El-Besawy
Abdallah Abdel-Hamid
(Nov. & Dec. only)

### 6. Guards

El-Sayed Ahmed El-Falawi
Moh. Mahmoud Al-Mashaly
Mostafa Basyouni El-Gamal

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1/ Farm Machinery 2/ Vehicles 3/ Laboratory 4/ On Training Leave
5/ Assumed Team Leader Responsibility on June 4.

## IV. Work Plans for the Next Two Quarters

1. Continue work on Dakalt Canal renovation, including collection of socio-economic data and *mesqa* surveying.

2. Routine data collection for summer season 1983 pilot program will be carried out including water measurements for the cotton, corn and rice crops.

3. Professionals from the various disciplines will determine topics for draft working papers covering the entire period of EWUP work at *Abu-Raya*.

4. Routine data collection will continue for the water budget.

5. A comprehensive summary report for the summer 1982 on-farm pilot work will be writte.

6. Data will be analyzed and summarized for all disciplines concerning the 1982-83 winter season pilot program.

7. A comprehensive summary report for the winter 1982/83 pilot program will be written.

# MINYA

## I. Summary of Accomplishments

During the first quarter of 1983 work at El-Minya continued to emphasize canal, *mesqa* and road improvement, according to the Master Plan for Unit Area Development, June 1982.

### A. Abyuha Canal Pilot Program

1. It was estimated that 10 percent of the construction contract to improve the Abyuha canal was not completed by the contractor. This work was continued by the EWUP team during the past quarter except for final compaction of the banks. It was impossible to achieve proper compaction without destroying much of the original construction. Since this was impractical we are left with the problem of making the best accomodation we can to poorly constructed banks. White stone has been delivered to the site and necessary "pitching" will be installed in areas not completed by the contractor during the off periods next quarter.

2. Weeds continue to be a problem. EWUP cooperated with the Irrigation Department in spraying and manually removing horse tail weeds.

3. Twenty head gates for *mesqa* intakes were manufactured at Zagazig. Six have been installed and the rest will be installed next quarter.

4. The sociologists held meetings with farmers and *mesqa* leaders to explain the need for controlling the water level in *mesqas*. Farmers were given keys to *mesqa* intake gates and they have agreed to be responsible for controlling the gates. This is considered to be a very positive Project achievement.

5. The sociologists explained to farmers the advantage of cooperating together on using permanent vents (3-5 farmers per vent) rather than each farmer individually cutting the *mesqa* bank to remove water. The farmers are beginning to adopt this procedure which promises to greatly improve the condition of *mesqa* banks.

B. *Mesqa* Improvement

1. A contractor started work on *mesqa* improvement in May. After a survey of harvest dates for wheat and beans the team recommended that work should begin on *Mesqas* 11, 12, 16, 19 and 25.

2. Meetings were held by the sociologists to explain the plan for *mesqa* modification and improvement. The farmers agreed to leave 3 meters of land uncultivated on each side of the *mesqas* in order to facilitate improvement work.

3. Team engineers established baselines for rebuilding *mesqas*.

4. The contractor eliminated *mesqa* #24 and in its place constructed a road using a bulldozer and a sheeps foot roller for compacting the soil.

5. I' was observed that the contractor was not following specifications. A letter was sent to the contracting company requesting that strict adherence to specifications should be followed on all work included in the contract .

6. A team meeting was held, attended by discipline leaders and the technical director, to discuss development priorities, location of lined canals and location of canals to be provided with turnout gates.

7. Engineer Esmat provided the contractor with specifications for *mesqa* intake pipes and tail escapes.

8. Project equipment and personnel was used to plow the banks of *mesqas* prior to the beginning of renovation by the contractor.

C. Land leveling

1. The Egyptian Agricultural Mechanization Project (EAMP) brought 4 tractors, three scrapers and a laser level to the Project site. Leveling was conducted at units 3,11 and 13 after the crops had been harvested. EWUP provided a tractor and plow to facilitate this work and made all arrangements with farmers.

2. Many meetings were held with EWUP and EAMP staffs to plan the work.

3. Approximately 100 *feddans* were leveled during the winter harvest period.

D. Other Activities

1. We arranged a field trip to Kafr El-Sheikh site for the Minya team and some of the farmers from the Abyuha area. We visited farms in the Kafr El-Sheikh area and observed methods used by farmers in planting cotton on beds between long furrows. As a result Abyuha farmers are now following the practices they observed at Kafr El-Sheikh. The new system saves labor and appears likely to increase yields in the Minya region.

2. The agronomists selected farms on *mesqas* #7 and #26 for irrigation by long furrows. This practice will probably not be fully accepted by farmers until they develop systems of mechanical cultivation.

3. Twelve farmers are being assisted to keep farm records. The information obtained from records is used to evaluate irrigation interventions and to develop crop enterprise cost reports.

4. Water measurements are made and recorded periodically for canals and drains serving the area. These data are used to construct water budget information.

5. Water samples from canals, drains and wells are collected monthly for analysis at the main office in Cairo. Dr. Assia is using this information for evaluating the potential of conjunctive use of water.

## II. Plans for the next quarter

1. Place pitching on right bank of Abyuha Canal kilo 1.450 to 1.750.
2. Install the iron gates at the intake of each *mesqa*.
3. Complete construction of improved *mesqas*.
4. Continue land leveling.
5. Continue building organization of water users.

## III. Personnel Assigned to Minya

Professionals

| | | | |
|---|---|---|---|
| Abdel Raouf Hassan | Team Leader | Erwin Nielsen | Ass. Team Leader |
| Tim Gates | Eng.half time | Abdalla Saber | Sociologist |
| Farouk Hassanein | Sociologist | Mohamed Awad | Agronomist |
| Ahmed Abdel Naim | Engineer | Nabil Farag | Economist |
| Esmat Wafik | Engineer | Elia Sorial | Economist |

| Techinicians | Drivers | Laborers |
|---|---|---|
| Eman Ebid | Khalaf Moh. Khalaf | Khalaf Saad |
| Nashat Younis | Farouk Hassan | Kamel Ahmed |
| Mahmoud Noman | Mohamed Esawy | Hemid Said |
| Bekhit Nazer | | Said Abdel Fattah |
| Mohy Yehya (resigned Feb.1) | | |
| Mohamed Allah | | |

## TASK GROUP 1 : ON-FARM WATER MANAGEMENT

### Objectives

1. The development of criteria for the proper frequency and amount of irrigation and the development of an acceptable procedure for implementing the criteria in the pilot areas.

2. The impact of various on-farm water management practices on soil properties, water table, and crop production.

3. The cost and benefits associated with the changes in delivery system for selected sites.

4. The sociological changes brought about by the various changes in *marwa* delivery systems and on-farm water management practices.

5. The on-farm water management practice of long furrows and/or borders as compared to conventional basins.

The major activities during the quarter for this Task Group pertain to preparation for the Workshop May 30 to June 2, 1983 and work accomplished by Dr. Dave Redgrave during his TDY assignment ending April 18, 1983. His activities will be reported first and the remainder of the activities reported herein will pertains to excepts of papers presented at the Workshop.

### Work Completed During The Quarter

1. Dr. Redgrave developed a data storage base and method of performing the calucations involved to assemble all irrigation data that have been collected. This was done cooperatively with Moheb Semaika who has now taken full charge of the data

base and calculations. Formats for the various types of data gathered at each location were developed and made specific for each crop studied. (The details of the data base system are given in a separate report).

A total of 65 data files have been established at this time; the initial calculations performed, and the results sent to the the field teams for review and correction. Additional data files will be established as information is received from the field sites.

Moheb Semaika has been placed in charge of this data collection and a coordinator will be named for each field team who will cooperate with Moheb in the collection and compilation of the outstanding data. The information being collected for the current season will be included in the data base as it becomes available.

A preliminary report has been written that briefly explains the data analysis procedure, raises questions about the methods and assumptions used and provides the framework for the inclusion of the final data set when it is available.

2. The following subjects and information were presented at the Workshop:

A. Long border/furrow irrigation vs small basin irrigation. Land leveling to prepare land for efficient irrigation with long border/furrows for comparison with small basin irrigation has been conducted in the Egypt Water Use and

Management Project at El-Minya, Mansuriya and Kafr El-Sheikh.

The land has been leveled with zero slope (dead level) with most of the long runs being 100 to 140 meters long on heavy textured soil. Small basins have ranged between 12 to 45 meters in length.

A concept is presented showing that the larger the non-erosive irrigation stream that is applied to dead leveled land, the higher the water-application efficiency may become if the time of flow is just sufficient for moisture to penetrate to the bottom of the root zone at the downstream end of the border.

Irrigation trials have been made with different measured rates of flow to selected areas planted with berseem, broad beans, wheat, cotton and corn. Moisture stored in the root zone has been measured with soil samples obtained before and after irrigations, and computed water application efficiencies have been plotted with respect to size of stream.

In some irrigation trials, the results indicated that larger streams result in higher water-aplication efficiencies. However, in many cases the efficiencies are lower. This reversal has been caused by allowing the water to flow unduly long during the irrigations on the newly leveled land.

In many cases there was no appreciable difference in the highest efficiencies of the small basins as compared to the long basins. The important finding here is that long borders can have water-application efficiencies that are as high or higher than those that have been attained in the small basins.

Long borders may be irrigated directly from *mamas* that are required with small basins. Modifications of this type in irrigation systems in the Project have resulted in improved irrigation efficiency.

These irrigation trials demonstrate the importance of providing instructions to teach farmers how to irrigate to take advantage of the benefits that long borders may make available to them. As in the United States where it has been found important to have an extension service to provide continued technical help for farmers, it will also be important to have a similar program in Egypt.

Farmers will need help especially where new recommended practices deviate considerably from customs that have been practiced by them for many generations.

B. Criteria for determining desirable irrigation frequencies & requirements and comparisons with convential frequencies and amounts measured by EWUP.

The on-farm irrigation measurements made by the Egypt Water Use Project were examined for the purpose of developing criteria for helping farmers decide when it is time to irrigate and how much to apply at each irrigation. The criterion for when to irrigate was based primarily on tensiometer measurements. The tensiometers indicated that for most crops 7 cm of water could be safely depleted from the soil between irrigations. By the time 8 cm were depleted, some tension measurements were already beyond the recommended maximum. Therefore except for permitting a somewhat greater stress period at the begining and one at the end of the growth cycle for cotton, as recommended

by the Ministry of Agriculture based on its research, and a stress period to permit wheat to mature at the end of its growth cycle, the recommended criterion is to irrigate when 7 cm of water have been depleted from the upper 90 cm of soil.

How to know when 7 cm have been depleted remains somewhat of a problem, since the use of tensiometers is not practical for a farmer with only one *feddan*. As an alternative, suggested irrigation schedules have been prepared, based on the best available estimates of consumptive use rates of the major crops in each of the three work areas chosen by EWUP. The date of each succeeding irrigation was determined by integrating under the CU curve until another 7 cm had been used. An attempt was made to avoid scheduling an irrigation during the winter closure period, but still some conflicts could appear. It is recognized that there are many possible errors from using this approach, so it is recommended that the irrigation advisors monitor at least one field in each group of farms following a particular schedule.

The calculated amount to apply at each irrigation was based on an assumed application efficiency of nearly 100% for Mansuriya, 95% for Kafr El-Sheikh, and 85% for Abyuha. These efficiencies were deliberately chosen very high in an attempt to gradually lower the water table during each cropping season. That is one reason why a certain amount of continued monitoring is recommended. Tables have been prepared with irrigation schedules which are proposed as the best for crops listed in the report.

Plans for Next Quarter

A. To work with Task Group members to summarize the EWUP findings for inclusion in a general final summary report.

B. To encourage and assist teams to continue to collect field data pertaining to irrigation frequency, amounts and efficiencies and to evaluate results.

Personnel Presently Assigned to the Task Group

Mona El-Kady, Martella, Hanson, Taher, Assia, Semaika, Farouk, Layton and Nadia.

## TASK GROUP 2 : WATER DISTRIBUTION SYSTEMS

### Objectives

1. Prepare and evaluate procedures for designing gravity distribution systems through canals and *mesqas*. Along with hydraulic principles consider aspects of minimum and maximum stream sizes required at the field inlet, and delivery by continuous flow, rotation, and demand schedules for peak demands and period of reduced demands.

2. Organize and evaluate operation and scheduling procedures for the El-Hammami pipeline.

3. Describe how farmers are organized around their present distribution systems and analyze how different types of farmer organizations may be established in response to changes in those distribution systems.

4. Measure and evaluate seepage losses in the El-Hammami Canal and in improved *mesqas* (lined and/or elevated) and other selected *mesqas*. Evaluated the effect of the improvements on seepage losses.

5. Using data obtained in seepage t s, evaluate the aspects of *mesqa* maintenance with respect to the efficiency of water delivery.

### Activities During the Quarter

A. Abyuha Area

Renovation and construction of *mesqas* Nos. 11, 12, 16, 19, and 5 was commenced and partially accomplished. Considerable work which

the contractor considered to be finished must be reworked because he has not compacted the soil for the channel and banks, nor has he followed the plans and specifications in constructing the shape and grade of the channel and banks.

B. Kafr El-Sheikh Area

The surveying of cross-sections of the Dekalt Canal and *mesqas* and the collection of associated base line data has been largely completed by the Kafr El-Sheikh team preparatory to the arrival of W.O. Ree in August to work on design and construction alternatives for the improvement of the watercourse system.

C. Mansuriya Area

*Mesqa* #10 continues to have periodic water shortages when the water demand is high on the Beni Magdul Canal. It appe · that this problem will never be solved without organizing all the farmers in the Beni Magdul command area and scheduling deliveries with control gates installed on the twenty-six *mesqas* and outlets along the Beni Magdul Canal.

D. El-Hammami pipeline has essentially no construction work completed on it this quarter.

E. The following subjects with abstracts were presented at the workshop May 30 - June 2, 1983:

1. A method of evaluating and revising irrigation rotations.

This paper presents a method of evaluating the efficiency of an irrigation delivery system for small farmers. It focuses

on how to determine if the water supply is sufficient, defficient or surplus without determining each individual farmer's daily needs. Instead the method looks at the aggregrate use by the farming community as determined by a farm record sampling. It then relates this to hydraulic information obtained from the Water Budget Analysis of inflow, outflow, and water level recorders. The information is then combined to determine possible modifications in the irrigation rotation system.

The case history of Dekalt Canal is used as an exmaple. This is a somewhat unusual canal in that the lower reaches tend to have surplus water. The analysis concentrates on identifying when these surpluses occur in a large enough volume so that an adjustment in the irrigation rotation would be feasible. This would realize a saving where it is still possible to reallocate the water for other parts of the Meet-Yazid Canal. A revised irrigation rotation was developed that could reduce the number of days irrigation water is diverted into Dekalt Canal by nearly 20 percent.

2. Computer assisted design and evaluation procedures for watercourse improvement.

An efficient set of procedures were developed which make use of limited manpower to design watercourse system networks in Egypt. This set of procedures, as developed, was denoted as the "Computer Assisted Design and Evaluation Procedures" (CADEP); The seven steps of the procedures, the associated computer programs, the assumptions made in their development, and suggestions for their application were presented.

The Computer Assisted Design and Evaluation Procedures (CADEP) are (1) survey the existing water course system to be investigared, (2) analyze and summarize the survey data, (3) calculate the hydraulic characteristics for a specified water delivery scheme, (4) design improved watercourse characteristics for specified alternatives, (5) determine construction scheme for each specified alternative, (6) evaluate the specified alternatives, (7) develop preliminary working (construction) drawings for the alternative(s) selected in (6). These procedures are apllied to watercourse system networks which consist of a secondary distribution canal serving several farm channels from which farms are directly irrigated. Key to CADEP is the specification and evaluation of design alternatives.

3. Hydraulic design of a canal system for gravity irrigation at Abyuha.

Abyuha Region, which is about 20 km south of El Minya, has 1200 *feddans* that are seviced by the 4000 meter long Abyuha Canal, a branch of the Ibrahimiya Canal. Thirty *mesqas* receive water from Abyuha Canal. Presently, about 60 percent of the region can be irrigated by gravity. *Tambours* or diesel centrafugal pumps serve the rest. Could the entire region be irrigated by gravity? The study to answer to this question led to the design of a gravity system for Abyuha. More importantly, it produced a generalized computer model and procedure for the design of any similar system. The workings of the model were illustrated using the Abyuha area and canal system as an example.

Plans for Next Quarter

1. A study by sociologists will be made to describe existing irrigation patterns by farmers which in turn will relate to needs for channel conveyance and distribution. The data will be collected next quarter and given an initial analysis.

2. Reports and/or data assembled to date will be reviewed to determine if additional write-ups should be made for inclusion in final reports.

3. If teams request assistance, help will be given as time permits.

4. W.O. Ree will serve on a TDY assignment to design and evaluate watercourse improvement alternatives for the Dekalt Canal system.

Personnel Assigned to Task Group 2

Mona, Hanson, Gates, Layton, Tinsley and Gamal.

## TASK GROUP 3: FARMER ORGANIZATION

### Objectives

1. To define the purpose and nature of a farmer organization.

2. To examine the existing organizational capabilities of the farmers.

3. To develop and analyze strategies for implementation of specific farmer organizations.

4. To analyze the procedures and administrative structure encompassing the farmer organizations at the specific field sites.

The work of this task group invloves three major forms of activities: (1) the actual development and sustaining of various farmer organizations, (2) the documentation of this process, and (3) the documentation of the existing situation of which the organization is part. Activity 1 is designed to accomplish objective 3 while activity 2 is designed to complete objective 4. Activity 3 is matched with objectives 1 and 2.

### Work Completed During The Quarter

A. Developing and Substaining Farmer Organization.

1. Minya

The development of both the *meaqa* organizations and the canal organization proceeded concurently with canal-area renovation.

There have been organization meetings of *mesqa* leaders throughout Abyuha to further explain the work and to receive feedback from the farmers. Also, each *mesqa* has been consistently visited by the Project sociologists to discuss the progress of the work with the leaders and farmers as related to their particular *mesqas*. The major effort this past quarter has been to work with the leadership of the *mesqa* and the farmers in order to develop a viable organizational pattern of behavior in which the leaders function as leaders and probems are solved in a collective manner when necessary.

2. Mansuriya: *Mesqa #10*

An organizational framework has been established . Periodic meetings with the leadership, and others, have been held. This organization is being used for the sharing and scheduling of the irrigations. Discussions have begun with the farmers for the transferring of the operation and maintenance of the *mesqa* from mostly EWUP control to that of the farmers' control have been continuing.

3. Mansuriya: El-Hammami

The work with the farmers has come to a standstill due to lack of progress by the contractor responsible for construction the bur. ied pipeline system.

B. Documentation of farmer Organization Work

The documentation of the organizational work will follow the six major procedural steps in organizing farmers:

1. identifying the local leadership,
2. contacting that leadership,
3. contacting the farmer,
4. establishing the organization,
5. sustaining the organization,
6. evaluating the organization.

All documentation will result from interviews and observation studies.

1. Accumulated leadership studies (complete for all of the three field sites with continual updating needed).

2. Contacting leadership (same as 1). A questionnaire was developed to find out what are the characteristics of the leaders chosen in the area. The questionnaire will be administered next quarter.

3. Contacting farmers (same as 1).

4. Establishing the organization.

   - Creating the structure of the organization (complete for Kafr El-Sheikh, *Mesqa* #10,and Abyuha).

   - Naming the personnel for the organization (same).

   - Establishing working procedures for the organization (complete *Mesqa* #10, Kafr El-Sheikh, and developing them in Abyuha).

5. Sustaining the organization.
   - EWUP interaction (in process for all areas). Documenting how EWUP works with the farmers in the particular organization.

6. Evaluating the organization (to be accomplished in future).
   - Performance under the existing structure.
   - Performance under the existing procedures.

C. Documentation of the Existing Situation

Efforts for this topic are focused on looking at how the farmers presently work together for particular practices and how other organizations affect the farmers' activities. The major source of this documentation is the system of recording and summarizing farmer contact records which delineate how the farmers are reacting to various project activities. These records are continually being kept.

Future Tasks for Next Quarter

A. Developing and Sustaining Farmer Organizations.

1. Minya

Continue with the efforts to make both the *mesqa* and the canal

organizations viable entities. Contact with all the leadership group will continue on a periodic basis with special efforts being made in special circumstances. The major concern and emphasis of work will be to involve the farmers in the *mesqa* renovation as much as possible.

2. Mansuriya

Work with the organization on *Mesqa* #10 to take over the new *mesqa*.

B. Documentation of Farmer Organization Work

Begin to analyze the data which have been collected for inclusion in the final report drafts.

C. Documentation of the Existing Situation

Same as B.

Personnel Assigned

Jime Layton, Farouk Abdel-Al, and Eldon Hanson.

TDY Support this Quarter

Frank Santopolo.

## TASK GROUP 4: FARM MANAGEMENT AND PLANNING

### Objectives

Farm Management and planning task group objectives are to evaluate alternative farming systems on Egyptian farms, to evaluate current agronomic practices as contrasted to recommended practices, and to evaluate the farmers' ability to implement improved agronomic practices.

### Activities Completed During Past Quarter

- Crop management studies, "Review of the Agronomic Practices Conducted by EWUP in the Project Sites".

- Working on the Internal Memorandum on Enterprise Cost Studies for Summer 1982.

- Tabulation for farm management survey data (1st. phase).

- Working on Farm Record Manual.

- Working on Technical Report on irrigation practices for years 1979/1980 - 1980/1981 - 1981/1982.

- Working on Farming System Technical Report.

- Drafts of the PTR on Farm Records of Selected Study Areas have been completed for the Abyuha, El-Hammami, Beni Magdul, and Abu Raya Areas. Editing and reviewing of the manuscripts is in process.

Plans for Next Quarter

- Complete the internal memorandum on enterprise cost studies for summer 1982.

- Complete the analysis of farm management surveys for El-Hammami, *Mesqa* #10 in El-Mansuriya, and *Mesqa* #26 at Abyuha.

- Complete the Farm Record Manual.

- Continue to keep farm record-books with the selected farmers to evaluate the alternative farming systems.

- Complete working on a PTR on Irrigation Practices, and Farming System Economic Analysis.

- Prepare reports and information needed for interdisciplinary major presentations at the National Conference.

Personnel Presently Assigned to Task Group #4

Farouk, Tinsley, Martella and Naim.

## TASK GROUP 5: THE WATER BUDGET

### Objectives

The objective of the water budget work for the remainder of the project are as follows:

1. To continue to collect complete water budget data (surface inflow and outflow, precipitation, weather station data for evaporation and evapotranspiration, water table elevations, specific yield, hydraulic conductivity, water quality, surface outflow) at each of the project sites.

2. To conduct regular periodic analysis of water budget data for each site with subsequent reports of results.

3. To produce an annual water budget report for each site.

4. To produce a final comprehensive report of the water budget work.

### Activities and Progress this Quarter

A draft of the report entitled "Water Budgets for Irrigated Regions in Egypt" was completed and presented at the EWUP Workshop (30 May - 2 June, 1983). A brief summary of this report is included in the appendix of this Project Quarterly Report.

### Plans for Next Quarter

Make additions and revisions to the above cited report.

Suggested Modifications in Long Range Plans

The objectives of Task Group five have been completed with regard to routine data collection at the Project sites; thus, direct involvement in planning and monitoring of routine data collection is being discountinued.

Personnel Presently Assigned

Mahmoud Ibrahim, Azza Nasr, Moheb Semaika and Tim Gates

Main Office Support Staff

Iman Saber and Laurette Gouel (P.T.)

Field Proffesional Staff

A. Abdel Naim (Abyuha), Wadie Fahim (Mansuriya) and Ahmed Ismail (Om Sen).

TDY Staff

W.O. Ree - Engineering, Data analysis.

## TASK GROUP 6: LAND LEVELING

### Objectives

To collect and analyse all EWUP information on land leveling and:

1. Evaluate farmers acceptance of new standards and practices.

2. Anaylse costs of precisions land leveling.

3. Assess the impact of leveling on on-farm water management.

4. Establish training for farmers to improve their own land leveling skills.

### Activities and Work Completed this Quarter

A. The major land leveling activities occurred in El-Minya where approximately 100 *feddans* were leveled using laser equipment provided by the Egypt Agricultural Mechanization Project (EAMP). Approximately four *feddans* were also leveled in Kafr El-Sheikh.

B. A report entitled "The Role of Precision Land Leveling in Egyptian Agriculture" was prepared for the Workshop of May 30 - June 2, 1983. In addition to describing the general need and benefits of land leveling, the report describes the favorable results experienced in El-Minya where the 100 *feddans* were leveled with laser equipment. The report is summarized as follows:

Small basin irrigation system is labor intensive requiring long hours to form the borders and to irrigate. The increase in labor hours for irrigation is due to the number of basins and the small streams used. With a decrease in the amount of available labor resulting in increasing labor costs, the use of labor saving irrigation systems and labor saving machinery will be required for efficient farming operations in the future. Currently, the use of machinery with small basin irrigation systems is not operationally feasible due to frequent stopping, starting, backing and turning of tractors etc. which results in low efficiency in the use of machinery.

Unless new machinery is developed specifically for small basin irrigation systems, future farming practices will require redesigning the field irrigation systems to relatively long border strips and/or furrows that will permit the use of conventional machinery to increase the productive capacity of the farmer. A healthy man can generate about 1/8 horsepower. With a 50 horsepower tractor he can theoretically do 400 times more work per hour. If this concept is applied in Egypt as farm labor becomes unavailable, the necessary adjustments can be made in farming practices with machinery to allow fewer farmers to feed the growing population in the coming years.

C. Results Observed in El Minya with Laser Leveling Equipment During April and May 1983: (from an interview with Dr. Nielsen)

1. Laser leveling is absolutely accurate and land can be leveled within one cm consistently. Water applied flows evenly and uniformly over the field. Irrigation time is reduced.

2. A presurvey of fields is not necessary with laser leveling. If cut and fill data are required, the equivalent to the pressurvey

can be accomplished by observing elevation readouts in the tractor while driving around the field one or two times.

3. Small widths of land (as narrow as 7 meters) can be leveled because the scraper-blade elevation system is completely independent and is not affected by the angle of the scraper tongue and tractor draw bar during turning. Sharp $90^{o}$ turns are not a problem.

4. One *feddan* can be leveled in approximately two hours. Leveling and smoothing the same area with regular equipment may require an entire eight-hour day.

5. The optimum field size for minimum earth movement is from 1/2 to 1 *feddan*. Larger fields usually require greater volume of soil per *feddan* to be moved to achieve the final elevation or grade. The field need only be wide enough for the tractor-scraper to turn around.

6. Individual leveling of small farms is much preferred by the farmer because it eliminates the problems of spreading weeds (especially grass roots) and top-soil from farm to farm. Each farmer retains the results from his previous farm management practices.

7. Laser leveling could be done at night as efficiently as in the day time, and three 6-to-7 hour work shifs a day could easily be accomplished. This schedule would allow for maximizing the amount of land that can be leveled in a given amount of time. In Egypt where two or three crops are planted per year and there is minimal time between harvest and plantings, this is espcially important.

Plans for Next Quarter

1. To review data collected to date and evaluate findings. Where findings are important, write appropriate reports for inclusion with material to be assembled in final reports.

2. To encourage teams to continue the program and to respond to requests for help as time permits.

Personnel Assigned to Task Group #6

Bayoumi, Hanson, Assia and Gamal.

## TASK GROUP 8: SOIL CHARACTERIZATION

### Objectives

1. To determine what soil management techniques are needed for best use of soil and improving water management.

2. To develop water management recommendations based on soil characteristics.

### Accomplishments

- Made 2 presentations at EWUP Workshop.
  1. Presented Technical Report 2, 33 & 34 on Soil Characterization Surveys of EWUP study sites.

  2. Presented Results of Water Management Interpertation of Soil Properties as contained in Staff Paper 60, and DWP's 113 & 114.

- Finished DWP 113: Problems of Irrigating Vertisols in Egypt.

### Plans for Next Quarter

Prepare Final Technical Report summarizing all irrigation related soil interpretation studies. This will be the final report of Task Group 8 and conclude it activities.

### Personnel Presently Assigned

Taher, Tinsley, Assia and Semaika.

## TASK GROUP 10: CONJUNCTIVE USE OF WATER

### Objective

1. Evaluate water collected from the main drains, canals and irrigation wells from the three project sites.

2. Classify the water from various sources for its suitability for irrigation.

3. Determine the consequences of using drainage water for alternative soil and crop situations.

4. Indicate special management practices necessary for using water of different qualities.

5. Determine the effect of using different combinations of water on the leaching requirements for alternative soil-crop situations.

### Work Completed During The Quarter

1. Water collected from canals, drains and observation wells from the three project sites are analyzed chemically.

2. A report on the water quality of irrigation canals, drains and ground water in Abu Raya area Kafr El-Sheikh governorate has been completed and presented in the Workshop, May 1983.

### Plans for Next Quarter

1. Report on the water quality at Minya and Mansuriya will be completed by September 1983.

### Personnel Presently Assigned

Assia, Hanson, Taha and Ikram.

## TASK GROUP 11: IRRIGATION ADVISORY SERVICE

The Irrigation Advisory Service (IAS) component of Task Group #4 has focused on two major areas of analysis in order to examine the existing situation in terms of establishing such a service. First, there is the need to document how EWUP presents its different pilot programs to the farmers with the purpose of describing how a possible prototype to an IAS may actually perform. Next, an examination of the organizational environment into which the IAS must implement its objectives needs to be delineated. From these two areas of analysis, the objectives of the task group have been created and the work activities have been designed.

Objectives

1. Make explicit provisions for providing the technical advice and assistance to farmers and farm organizations served by the pilot studies which will at least:
   Provide technical advice and assistance to the individual farmer on irrigation practices and systems by cooperating with the existing extension service, village cooperative, and farmer organization. Provide technical advice and assistance to the farmer organizations, which will be needed if the farmer organizations are to be successful, on expected water requirement, irrigation scheduling, maintenance of *mesqas* and drains, etc.
   Establish the responsibility for specifying the nature of and the person responsible for providing the technical assistance for each pilot study.

2. Develop criteria and procedures for establishing a countrywide IAS. To define what should be the purpose and parameters

IAS. To delineate how an IAS is to be organized in terms of its of an personnel, administrative structure, procedures and progams.

To examine how the IAS is to be integrated into the existing institutional structure, i.e., what role will this service play in terms of other organizations.
To examine the preparatory and training aspects of the staff members for this advisory service.

To examine the preparatory and training aspects of the staff members for this advisory service.

Tasks Completed

- Evaluation studies of the Kafr El-Sheikh work in terms of interacting with the farmers are now being anlyzed in terms of the task group objectives.

- The Project's work with the farmers on *Meaqa* #10 in Mansuriya has been documented for the past year through a special study examining how an innovation is presented to a receiver group. Data from that study are now being tabulated and analyzed.

- the questionnaire designed to provide the information for objective two has been administrating in Kafr El-Sheikh and Minya.

- The analysis of those data will begin when Dr. Knop comes in July.

Future Tasks for Next Quarter

- The questionnaire designed by Dr. Knop is to be analyzed.

- Analysis of the evaluation studies in Kafr El-Sheikh and of the special study on *Mesqa* #10 will be continued next quarter. Completion of these analyses will be done for inclusion in the final report.

- Analysis of the contact records describing the Project's efforts in implementing the various programs will continue.

Personnel Presently Assigned

Jim Layton-Coordinator, Moheb Semaika and Gamal Ayad.

TDY Support this Quarter

Frank Santopolo.

TDY Support Next Two Quarters

Ed Knop

## MAIN OFFICE

The technical work of the main office is done through eleven task groups. The work is performed by 27 professional staff members with TDY assistance as indicated in the "Backstopping" portion of this report. The main office and TDY staff work with field team personnel at each of the three Project sites to conduct demonstrations and field tests, collect data, and carry out plans for interaction with farmers and local government officials.

The following is a complete list of personnel assigned to the Main Office as of June 30, 1983.

| | |
|---|---|
| Hassan Wahby | Project Director |
| Gene Quenemoen | Technical Project Director |
| Farouk Abdel Al | Economics Discipline Leader |
| David Martella | Economics Disc. Counterpart |
| Ahmed Maher | Deputy Institute Director |
| Gamal Ayad | Senior Economist |
| Ahmed Taher | Agronomy Disc. Leader |
| Richard Tinsley | Agronomy Disc. Counterpart |
| Mohamed Abdel Naim | Senior Agronomist |
| Assia El-Falaky | Senior Agronomist |
| Moheb Semaika (66% time) | Senior Agronomist |
| Mona El-Kady | Engineering Disc. Leader |
| Eldon Hanson | Engineering Disc. Counterpart |
| James Layton | Sociology Disc. Counterpart |
| Mohamed Naguib | Sociologist |
| Yousria Allam (50% time) | Sociologist |
| Mohamed Helal* | Computer Engineer |
| Azza Nasr | Computer Engineer |
| Tim Gates | Engineer-Water Budget |
| Mahmoud Ibrahim | Computer Engineer |
| Iman Saber | Technician |
| Ahmed Bayoumi | Farm Mechanization Engineer |
| Nadia Wahby* | Senior Eng. Water Requirements |
| Abdel Atti Allam* | Engineer - Water Requirements |
| Wadie Ragy | Engineer - Water Requirements |
| Mohamed Nabil Naguib | Engineer - Water Requirements |

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* on leave without pay.

| | |
|---|---|
| Farida Abdel Meguid 1/ | Engineer - Water Requirements |
| Mohamed Ahmed Salem | Senior Adminis. Personnel |
| Mohamed Sail El-Shatter | Senior Adminis. Expeditor |
| Salah El-Din Salem | Junior Adminis. Secretary |
| Sayed Sakr | Junior Adminis. Storekeeper |
| Zeinab Abdel Ghany | Junior Adminis. Inventory |
| Ekhlas Abdel Ghaffar | Junior Adminis. Secretary |
| Magda Yassin Mahmoud | Junior Adminis. Arabic Typist |
| Ashgan Abdel Zaher | Junior Adminis. Photocopier |
| Bamba Shaarawy | Junior Adminis. Photocopier |
| Iman Abdel Gaber | Junior Adminis. Accountact |
| Maher Attallah | Junior Tech. Mechanical Work |
| Abdel Naby Youssef | Techn.-Mechanical, Motor Pool |
| Ahmed Soliman Abdallah | Techn.-Mechanical, Motor Pool |
| Ahmed Ibrahim | Junior Administrative, M.P. |
| Said El-Said Elwi | Junior Administrative, M.P. |
| El-Araby Mansour Shahin | Junior Technician, Electrician. |
| Imam Sayed Washba | Technician |
| Osman Shaker | Junior Admin. |
| Shaaban Mohamed Abdou | Telephone Operator |
| Ahlam Abdel Rahman 1/ | Junior Admin. Accountant |
| Taha Moustafa | Eng.-Water Laboratory |
| Ikram Mohamed 1/ | Eng.-Water Laboratory |
| Ahmed Ghanem | Techician-Water Lab. |
| Abdalla Gad | Techician-Motor Pool |
| Ahmed | Guard-M.P. |
| Moustafa Mahmoud Mahran | Electrician-M.P. |
| Saad Mansour | Management Ass. for Finance |
| Nawal Abdallah Ahmed | Accountant - Main office |
| Magda Moh. Mahrous | Ex. Secretary - Main Office |
| Mala Mokhtar Awad | Secretary - Main Office |
| Mervat Hassan | Secretary - Main Office |
| Hannan Samuel | Secretary - Main Office |
| Mary Halim | Editor - Main Office |
| Hamdi Ahmed Hamdi | Translator- Main Office |

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1/Leave without pay

## TRAINING

During the past quarter the following persons terminated their participant training in the United States:

Gamal Fawzy, Economist, Colorado State University
Kamal Ezz El-Din, Engineer, Colorado State University
Mohamed Awad, Agronomist, Colorado state University
Magdi Awad, Agronomist, Colorado State University
Ahmed El-Attar, Sociologist, Colorado State University

Amany El-Kayal, Engineer is still in training at Utah State University under a Peace Fellowship.

The following persons were selected for training and approved by USAID during the past quarter. Implementation of these training opportunities is in progress.

Ahmed Bayoumi, Engineer, 2 months at CSU
Safaa Fahmy Mohamed, Engineer, 1 month at USU
Mohamed Lotfi Nasr, Economist, 6-weeks at CSU
Moheb Semaika, Agronomist, 3 weeks at CSU
Sohair Youssef, Sociologist, 6 weeks at CSU
Ahmed Ghidan, Engineer, 1 month at USU
Abdel Raouf, Engineer, 3 weeks at CSU
Sabah El Sayed, Agronomist, 9 months at CSU
Ragy Darwish, Economist, 9 months at CSU
Tarief Zaitoun, Engineer, 9 months at CSU
Farouk Abdel Al, Sociologist, 9 months at CSU

More rigid enforcement of English language proficiency by USAID before approving training has required that more time of Egyptian pro-

fessional staff must be devoted to taking language classes. Although this policy creates additional constraints on accomplishing planned field work due to shortage of Egyptian staff it will probably result in more effective participant training and long-run accomplishment.

Dr. Layton has spent at least 1 man month during the past quarter assisting the IMS Project to take over the on-farm water management course. He will reside at Kafr El Sheikh during July and August in order to assist the all-Egyptian staff. Other EWUP American staff members residing in Cairo will travel to Kafr El-Sheikh to give some lectures during the training period.

As reported in the Introduction of this report an evaluation was conducted of the Salt River Project Exchange program and plans are underway to request a Phase II program. During the past quarter Don Womack and Sid Friar completed eight weeks in Egypt returning to the U.S. on April 26. Egyptian engineers Ibrahim Gad and Essam Mohamed were in Arizona for eight weeks. They returned to Cairo on April 9, 1983. They were followed by Engineers Ramsis Pakoum Lotfy and Hassan Ali El-Attafi who left Cairo on June 17 and expect to return in mid August.

## PUBLICATIONS REPORT

There were no new publications released from the Project office in Egypt during the past quarter. The publications progress report from the 1st quarter 1983 is up-to-date.

The activity of the technical editor was mostly devoted to publishing papers for the Workshop held May 29 through June 2. In addition editing has been completed on several publications which will be printed and released the next quarter.

## II. BACKSTOPPING

### Planning and Coordinating Committee

The Planning and Coordinating Committee met weekly to plan project activities, review and work on reports, and discuss work plans with the TDY's. Committee members worked on the training programs and provided orientation for the Egyptian professionals who are taking non-degree graduate training at Colorado State University. The committee members also backstopped the discipline needs for the Egyptian and American staff in Egypt. Additionally, the committee members helped plan the project workshop, and National and International Conferences on farm water management to be held in Cairo.

The project workshop was held May 30, 31 and June 1. The purpose of the workshop was to review the status and conclusions of the project research, identify those areas where additional work is needed, and to provide the occasion for all the project researchers from the field stations and Cairo to meet together to discuss and review the projects activities. The workshop was a successful means of focusing the project's goals in the closing year of American involvement. A copy of the papers presented at the project workshop are attached.

Drs. Dan Sunada, Bill Shaner, Wayne Clyma and George Radosevich traveled to Cairo to attend the workshop, review the project's work, and discuss the project workplans for the coming year.

The National Conference is scheduled for the 27, 28 and 29 of November. The Universities, the Ministry of Irrigation, the Ministry of Agriculture, and other interested professionals have been invited to attend the conference.

Dr. McConnen has been helping with the organization of the National Conference along with the International Conference to be held in Spring 1984.

Salt River Project

This quarter a mid term evaluation of the Salt River Project - Ministry of Irrigation Exchange Program was successfully concluded. The Ministry of Irrigation has asked the Salt River Project to extend the Exchange Program and is preparing a proposal asking U.S. AID to approve funding through the IMS project of Phase II of the program through June 1988. Conclusions and recommendations of the review are in the appendix. Phase II of the exchange exchange program would be structured to concentrate on the following areas:

a. Data communication

b. Water measurements

c. Operation and maintenance

d. Project management and management reporting (including preparation of annual reports).

e. Design of irrigation structures

f. Management and decision making processes

- Development of ideas for improvement
- Gathering relevant information
- Analysis of information
- Making a decision
- Action or implementation of the decision
- Evaluation

g. Conjunctive use of surface and groundwater

Phase II of the program will continue the exchange of Salt River project personnel and Ministry of Irrigation engineers. Additionally, an annual summer intern program at the Salt River Project for two engineering students from Zagazig University's Department of Irrigation will be established.

Fort Collins Staff

Dr. Mel Skold and Trainee Gamal Fawzy completed their report on Egyptian Farming Systems for Task Group 4. The report significantly extends EWUP's research in the economic discipline.

Tom Ley completed his revision of project technical report No. 38, "Precision Land Leveling on Abu Raya Farms, Kafr El Sheikh, Egypt." Ley also revised the report on the HP 9825 computer land levelling program for publication as EWUP Manual No. 5. He continued his analysis of the USDA - SCS level basin irrigation design model and a zero inertia level basin design model. It is expected that the result of this analysis will be a set of recommendations for improved application of the SCS model under Egyptian conditions.

Arrangements for a study tour for the present trainees were made and a training program for the summer trainees was developed in consultation with the P&C Committee and Cairo.

The Fort Collins staff has published three project technical reports this quarter and prepared two more for publication. The publication status of the Project Technical Reports assigned is as follows:

| | |
|---|---|
| PTR #16 | Abstract sent to Cairo for translation |
| PTR #17 | Abstract sent to Cairo for translation |
| PTR #18 | Printed |
| PTR #21 | Printed |

| | |
|---|---|
| PTR #27 | Authors are reviewing |
| PTR #35 | Printed |
| PTR #36 | Printed |
| PTR #37 | Printed |

## Training

Five trainees completed their eight month academic training tour at Colorado State University. A list of the trainees, and the courses they took spring semester follow.

| NAME | COURSES | | CREDITS |
|---|---|---|---|
| Agronomy | | | |
| Magdi Awad | AG470 | Soil Physics | 3 |
| | AG471 | Soil Physics Laboratory | 1 |
| | AG666 | Salinity and Soil Water Mgmt | 3 |
| | AG564A | Chemical Analysis-Saline and Sodic Soils | 1 |
| | GS670 | Inter. Agricultural Development | 3 |
| | AG795 | Independent Study | 4 |
| Agronomy | | | |
| Mohamed Awad | AG470 | Soil Physics | 3 |
| | AG471 | Soil Physics Lab | 1 |
| | AG666 | Salinity and Soil Water Mgmt | 3 |
| | AG564A | Chemical Analysis-Saline and Sodic Soils | 1 |
| | GS670 | Inter. Agric. Development | 3 |
| | AG370 | Irrigation | AU |

Economics

| | | | |
|---|---|---|---|
| Gamal Fawzy | EA505 | Agricultural Production Economics | 3 |
| | EA510 | Agricultural Marketing | 3 |
| | GS670 | Inter. Agricultural Development | 3 |
| | EA695 | Independent Study | 1 |
| | EA540 | Agricultural Finances | AU |
| | EC542 | Econ. Analysis of Water Development | AU |

Engineering

| | | | |
|---|---|---|---|
| Kamal El Din | CE615 | Open Channel Flow | 3 |
| | CE544 | Water Resources Planning | 3 |
| | CE514 | Hydraulic Structures | 3 |
| | GS670 | Inter. Agricultural Development | 3 |
| | AG370 | Irrigation | 3 |

Sociology

| | | | |
|---|---|---|---|
| Ahmed El Attar | S 210 | Intr. to Social Research | 3 |
| | AD629 | Program Development | 3 |
| | PR600 | Research Methods | 2 |
| | S 795 | Independent Study | |
| | AD620 | Processes and Methods | 3 |

In addition the five academic trainees participated in a short training tour which included visits to the Fruita Research Station in Grand Junction, the Snake River Water Conservancy Research Lab in Kimberly Idaho, and the Agricultural Development Systems Project at the University of California, Davis.

Kamal Nasr El Din, one of the trainees, successfully completed the 8 month program in Irrigation Engineering at the International School for Water Resources at Colorado State University.

Other Academic Training

Engineer Amany El Kayal is making good progress on her M.S. degree program at Utah State University under a Peace Fellowship. She plans to take her orals during the third quarter.

Summer Short Course Training

Sohair Kamal Yousef attended Dave Freeman's short course titled, "Social Technical and Economics Aspects of Improved Irrigation Management," June 10 - July 29, 1983.

Abdel Raouf attended Bill Schmehl/Bill Shaner's short course titled, "Farming Systems Research: On Farm Methodologies," June 10 - July 9, 1983.

Salt River Project Exchange

Ibrahim Ismail Mohamed Gad and Essam Monofie Sheikh spent February 20 to April 1, 1983 working and training at the Salt River Project in Phoenix, Arizona. Prior to the time in Phoenix they spent a week in Fort Collins in orientation and participating in a study tour of Colorado irrigated agriculture. They also took a study tour of irrigation districts in Western Arizona and Southern California. The itinerary for the two men at the Salt River Project is in the Appendix.

Mr. Ed Kirdar, Mr. Marcel Boulais, Mr. Robert Mason, and Mr. Jack Phister from SRP travelled to Cairo to participate in the mid project review of the exchange program.

EQUIPMENT

The two slave disc drives for the HP9825 were received and shipped by air freight.

The diesel generator for El Hammami has been ordered and it is due for completion in August.

All instruments and supplies for the mobile soil lab have been ordered but none of the items have been received.

The Hewlett-Packard model 41 CV calculator system was hand carried to Egypt by Tim Gates.

Replacement recorders for wind measurements at the weather station were sent.

All other equipment, parts and supplies have been purchased as requested.

TDY's

Temporary duty personnel worked with the EWUP staff on a variety of problems this quarter.

As mentioned previously Drs. Clyma, Radosevich, Shaner and Sunada participated in the project workshop and reviewed, critiqued, and helped with the rewriting of the project papers presented at the workshop.

Other TDY personnel worked on reports on the construction, operation, and maintenance of canal systems, water budget studies, canal lining cost studies and sociological studies on the social dynamics of daily activities on the mesqas.

A list of the TDY's in Egypt this quarter follows.

Dr. Wendell Gwinn, Engineer (March 9, 1983 - June 4, 1983) to write a report on construction, operation and maintenance of the Abueha Canal System.

Dr. Dave Redgrave, Agronomist (March 3, 1983 - April 29, 1983) to work with Dr. Taher and others on the water depletion report for Kafr El Sheikh.

Mr. Bill Ree, Engineer (March 16, 1983 - May 30, 1983) to assist Task Group 5 analyze and prepare water budget reports.

Mr. Sid Friar, SRP (March 9, 1983 - April 20, 1983) to increase the professional competence of the participants by an exchange of literature, information and on the job training relative to irrigation problems and practices in Egypt and USA. Exchange between SRP and MOI.

Mr. Don Womack, SRP (March 9, 1983 - April 20, 1983) to increase the professional competence of the participants by an exchange of literature, information and on the job training relative to irrigation problems and practices in Egypt and USA. Exchange between SRP and MOI.

Mr. John Andrew, Engineer (May 10, 1983 - August 1, 1983) to prepare a technical report on costs under Egyptian conditions of alternative systems of canal lining.

Dr. Wayne Clyma, Engineer (May 24, 1983 - June 13, 1983) to review, criticize and assist with rewriting project reports to be presented at a workshop in May & June.

Dr. Frank Santopolo, Sociologist (June 21, 1983 - July 31, 1983) to work with Task Groups 3 and 11 to document EWUP's work with farmers.

Dr. Dan Sunada, Engineer (May 16, 1983 - June 7, 1983) to assist in the study of the Dakalt Canal. Assemble water budget information and other hydrologica data.

Dr. Bill Shaner, Engineer (May 26, 1983 - June 10, 1983) to review, criticize and assist with rewriting project reports to be presented at a workshop in May & June.

Dr. George Radosevich, Economist (May 26, 1983 - June 9, 1983) to review, criticize and assist with rewriting project reports to be presented at a workshop in May & June.

Mr. Ed Kirdar, SRP (May 24, 1983 - June 2, 1983) mid term evaluation of Salt River Project and Ministry of Irrigation Exchange.

Mr. Marcel Boulais, SRP (May 24, 1983 - June 2, 1983) mid term evaluation of Salt River Project and Ministry of Irrigation Exchange.

Mr. Robert Mason, SRP (May 24, 1983 - June 2, 1983) mid term evaluation of Salt River Project and Ministry of Irrigation Exchange.

Mr. Jack Pfister, SRP (May 24, 1983 - June 2, 1983) mid term evaluation of Salt River Project and Ministry of Irrigation Exchange.

Work Plans

Logistical support and academic advising for the Egyptian summer training participants will continue. Special study program are being arranged for trainees arriving in July and August. Additionally, a study tour of irrigation in the American Southwest is being arranged for a group of 35 Egyptian Engineers from the IMS project. This 3 week tour will involve visits to farmers, irrigation districts, and irrigation projects and research

laboratories of the United States Department of Agriculture and the Bureau of Reclamation. The tour will be organized around the subject of the design and maintenance of irrigation delivery systems.

Advance arrangements for the trainees expected next fall will begin. The selection of academic advisors, course schedules, and housing and transportation arrangements will be made.

Orientation programs will continue to be developed for American project staff traveling to Egypt, Salt River Project personnel, and Egyptian trainees traveling to the United States. More of the orientation is being done directly by the Fort Collins staff. Because of the increase in their experience and a decrease in the number of trainees and staff visiting the United States or Egypt for the first time.

Work on a project presentation for the Consortium for International Development (CID) board meeting in July continues. Dr. Wahby and Dr. Richardson will represent the project at this CID review.

Planning for the National and International Farm Water Management Conferences in Cairo continues. The National conference will be held in late November and the international conference in the Spring of 1984. These conferences will provide forums for the dissemination and discussion of the projects findings.

The publication activities in Fort Collins will continue. Upon completion of the Project Technical Reports assigned to Fort Collins the publishing activities will shift to the reproduction of papers written by project members and published in referred journals.

In addition to these activities, the Fort Collins staff and the Planning and Coordinating Committee reviewed and helped edit all new Staff papers and Project Technical Reports.

The Planning and Coordinating Committee will continue to revise and update their recommendations to the Ministry of Irrigation on the National Irrigation Improvement Program.

The Salt River Project exchange will continue with two Egyptians going to Phoenix and two Americans travelling to Egypt this fall.

## III. PERSONNEL

### Field Staff

No change Tim Gates and Eldon Hanson were on home leave during this quarter.

### Campus

The following people will be in Egypt TDY next quarter:

| | |
|---|---|
| Ed Knop | 7/14/83 - 8/11/83 |
| Richard McConnen | 7/16/83 - 8/83 |
| Terry Podmore | 7/14/83 - 8/14/83 |
| Mel Skold | 7/23/83 - 8/18/83 |
| Jim Warner | 7/14/83 - 8/20/83 |
| E. V. Richardson | 8/1/83 - 8/29/83 |
| Ron Grosch | 9/28/83 - 10/8/83 |
| Sid Wilson | 9/28/83 - 10/8/83 |
| Bill Ree | 9/6/83 - 1/6/84 |

# APPENDIX

Workshop Agenda

Workshop Reviewers

Summary of Workshop Papers

MOI/SRP Protocol Agreement

# EGYPT WATER USE AND MANAGEMENT PROJECT

## Workshop Agenda

May 30 - June 2, 1983

Ramsis Hilton Hotel

Cairo

*****

Monday
May 30

Chairman - Hassan Wahby

0930 - 1000 Opening

1000 - 1030 Egyptian Irrigation System and EWUP Role.
* Hassan Wahby

1030 - 1100 EWUP Approach for Increasing Welfare of Farmers
* Gene Quenemoen

1100 - 1130 Break

Chairman - Ahmed Maher

1130 - 1230 The Role Land Leveling in Egyptian Agriculture
* Eldon Hanson and A. Bayoumi

1230 - 1330 Long Furrow vs. Small Basin Irrigation
* Eldon Hanson

1330 - 1430 Lunch

Chairman - Gene Quenemoen

1430 - 1530 Optimum Irrigation Frequency
* Mona El Kady

1530 - 1600 Break

1600 - 1700 Evaluation of Rotation System
* Dick Tinsley

Tuesday
May 31

Chairman - Mona El Kady

0930 - 1030 Proposals for Irrigation Scheduling
* Dick Tinsley

1030 - 1130 Computer Assisted Design and Evaluation Procedures for Watercourse Improvement Programs
* David Martella and Tim Gates

1130 - 1200 Break

Chairman - Eldon Hanson

1200 - 1300 Hydraulic Design of Gravity System for Abyuha Canal
* Bill Ree and Tim Gates

1300 - 1400 Minya Pilot Program
* Abdel Raouf and Erwin Nielsen

1400 - 1500 Lunch

Chairman - Dick Tinsley

1500 - 1600 Mansuriya Pilot Program
* Wadie Fahim and Bill Braunworth

1630 - 1730 Break

1630 - 1730 Kafr El Sheikh Pilot Program
* Abdel Fattah Metawie & K. Litwiller

Wednesday Chairman - Farouk Abdel Al

June 1 0930 - 1030 Experience with Water Users Associations
* Jim Layton

1030 - 1130 A Proposed Irrigation Advisory Service
* Mohamed Naguib

1140 - 1200 Break

Chairman - Mohamed Naguib

1200 - 1300 Irrigation Practices of EWUP Study Cases
* Farouk Abdel Al and Dick Tinsley

1300 - 1400 Results of Crop Management Trials
* Mohamed Abdel Naim

1400 - 1500 Lunch

Chairman - Ahmed Taher

1500 - 1600 Economic Analysis of Farming System
* Farouk Abdel Al & David Martella

1600 - 1630 Break

1630 - 1730 Water Budgets for EWUP Field Sites
Tim Gates and Mahmoud Ibrahim

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Thursday Chairman - David Martella

| | | |
|---|---|---|
| June 2 | 0930 - 1030 | Review of Soil Fertility Surveys<br>* Ahmed Taher |
| | 1030 - 1130 | Review of Soil Characteristics Studies<br>* Ahmed Taher |
| | 1130 - 1200 | Break |

Chairman - Jim Layton

| | |
|---|---|
| 1200 - 1300 | Irrigation Management of Soils at EWUP Sites<br>* Ahmed Taher and Dick Tinsley |
| 1300 - 1400 | On the Water Quality of Irrigation Canals, Drains and Groundwater in Abu Raya Area, K.El-Sheikh<br>* Assia El Falaky |
| 1400 - 1500 | Lunch |

Chairman - Hassan Wahby

| | |
|---|---|
| 1500 - 1600 | General Comments<br>* Review Team |
| 1600 - 1630 | Break |
| 1630 - 1730 | General Comments<br>* Review Team |

Note:

The review team may schedule meetings with groups of EWUP staff the week following the workshop for further discussion and recommendations.

## Workshop Reviewers

Dr. Mahmoud Abu Zeid
Chairman, Water Research Center
Ministry of Irrigation
Cairo

Dr. Daniel K. Sunada
Professor, Departmant of Civil Engineering
CSU
Ft. Collins

Dr. Ali Serry
Chairman, Agricultural Research Center
Ministry of Agriculture
Cairo

Dr. Wayne Clyma
Professor, Department of Agricultural and Chemical Engineering
CSU
Ft. Collins

Dr. Willis W. Shaner
Assoc. Professor, Department of Mechanical Engineering
CSU
Ft. Collins

Dr. Ibrahim El-Assiouty
Professor, Head of Irrigation Division, Faculty of Engineering
Cairo University
Giza

Dr. George Radosevich
Assoc. Professc  Department of Economics
CSU
Ft. Collins

Dr. Charles Bailey
Program Officer, Ford Foundation
Khartoum,
Sudan

SUMMARIES OF THE PAPERS
TO BE PRESENTED AT THE WORKSHOP
MAY 30 - JUNE 2, 1983

(These papers have not been edited for publishing.
Please do not quote without Authors permission)

a field with a planed grade to allow more efficient water application. Land smoothing is generally the term applied to the final step in PLL, which removes the minor irregularities and increases the precision.

Precision land leveling is a necessary condition for improving farm water management when surface irrigation is the method of water application. This is true when PLL is done to achieve some uniform grade in the direction of advancing irrigation water or when it is done to achieve a uniform zero grade or dead level. PLL is necessary for the removal of surface irregularities in fields which cause poor distribution of applied water, lead to salinity and waterlogging problems and result in poor water application efficiency, among other things. A review of the expected benefits of PLL illustrates why it should be considered for improving farm water management:

1. Improved irrigation application efficiencies
   a. irrigation water savings
   b. irrigation time savings
   c. irrigation labor savings.

2. Reduces salinity problems
   a. high spots receiving too little water are eliminated
   b. uniform water application improves leaching effectiveness.

3. Reduced waterlogging problems
   a. Low spots receiving too much water are eliminated
   b. improved ability for applying precise amount of water reduces overirrigation; aids water table management.

4. Uniform water applications for improved germination.

5. Less fertilizer losses due to overirrigation and deep percolation.

6. Higher yield should result because of items 1 to 5.

7. Land in production increased
   a. non-productive bunds and boundaries removed because larger fields can be irrigated as a unit
   b. area occupied by distribution ditches decreased

8. Farm water delivery losses reduced due to fewer distribution ditches
   a. improves farm irrigation efficiency
   b. reduces waterlogging problems next to farm distribution ditches.

PLL is a necessary condition for achieving the above benefits, however, it alone is <u>not</u> sufficient. Controlling water application in surface irrigation requires establishing the appropriate boundaries, which, in turn, is dependent upon development of an appropriate design. Surface irrigation design is dependent upon numerous physical factors such as soils, water supply, crop, climate, etc., as well as many management factors such as irrigation frequency. It thus becomes obvious that PLL, surface irrigation design and irrigation water management must be treated as a unit with each component receiving the proper development and attention before farm water management can in reality be improved. The neglect of any of these three components leads to failure. This report will focus on precision land leveling.

It must be recognized that PLL cannot be done without giving attention to limiting factors such as soil types and profiles, soil fertility, general topography, crops to be grown, irrigation method and climate. Each of these may constrain the amount of leveling that can be done, the amount

of soil that may be cut, the costs that may be justified, etc. Available machinery and technical assistance (including instruments and trained personnel) may be severely limited.

Efficient use of manpower and machinery is another important aspect of land leveling. Without land leveling it would be impracticable to modify the topography and irrigation systems to make land accessible to farm machinery and convert small basin irrigation to the use of long borders/ furrows.

The small basin irrigation system is labor intensive requiring long hours to form the borders and to irrigate. The increase in labor hours for irrigation is due to the number of basins and the small streams used. With a decrease in the amount of available labor, resulting in increasing labor costs, the use of labor saving irrigation systems and labor saving machinery will be required for efficient farming operations in the future. Currently, the use of machinery with small basin irrigation systems is not operationally feasible due to frequent stopping, starting, backing and turning of tractors etc. which results in low efficiency in the use of machinery.

Unless new machinery is developed specifically for small basin irrigation systems, future farming practices will require redesigning the field irrigation systems to relatively long border strips and/or furrows that will permit the use of conventional machinery to increase the productive capacity of the farmer. A healthy man can generate about 1/8 horsepower. With a 50 horsepower tractor he can theoretically do 400 times more work per hour. If this concept is applied in Egypt as farm labor becomes unavailable, the necessary adjustments can be made in farming practices with machinery to allow fewer farmers to feed the growing population in the coming years.

(DRAFT)

# LAND LEVELING WITH A LAND PLANE VS LASER LEVELING

## A. Summary:

1. For laser controlled leveling, a sending unit is mounted on a tall tripod near the field as shown in Fig. 1. The receiving unit is mounted on a scraper drawn by a tractor. The combined length of a tractor and scraper is very short; 90% turns are not a problem and the scraper blade elevation is under constant cortrol. Guess work is eliminated. Because of this, laser leveling equipment can work in corners and narrow strips of land. Land planes require wide areas for turning because they are long and sharp. 90% turns are impossible.

2. Field boundaries may be any configuration. The field efficiency of laser leveling equipment is greater than that of regular leveling and planing equipment. Either type of equipment can work well on large areas where turning is minimized.

3. As areas become smaller, laser equipment efficiency with respect to land planes increases because of its mobility, and the quantity of soil moved per feddan diminishes Efficiency of regular equipment goes down more rapidly because of turning problem.

4. Farmers prefer separate field leveling because transfer of top soil and weeds from farm to farm is eliminated.

5. Laser equipment may cost approximately L.E. 40,000.

## B. How laser Equipment Works to Level or Survey Land:

Laser equipment consists of an emitter mounted on a tall tripod near the field to be leveled (See Fig.1). The emitter sends out a pencil thin beam of light and rotates at selected speeds up to 12 times per second which in effect forms a plane of laser light. The emiter automatically adjusts itself (elimination operator error) so that the plane of light is in a horizontal (dead level) position. It may also be inclined to have the plane of light on any desired degree of slope in either direction.

A receiving unit (or sensor) is mounted on a mast above the blade of the scraper. This sensor is a 360° photo electric cell which receives light from any direction. The receiver is divided into three sections to indicate "on grade","above grade", or "below grade" on the control panel in the tractor operators' cabin. During land leveling operations, the mast holds the receiving sensor at a fixed position above the center of the blade of the scraper.

The mast may be telescoped up or down to change the elevation of the scraper blade. A switch on the control panel puts this under control of the operator. The digital read out displays the elevation in millimeter units, giving the tractor operator absolutely accurate and continuous control of the elevation of the scraper blade.

With a land plane the tractor operator has to guess or estimate how close he is working to the survey specifications while he drives from stake to stake. Stakes may be spaced 10 meters to 30 meters apart. After another survey, the process of land leveling may have to be repeated.

The laser sensor reacts to stay in the middle of the laser beam. Electronic signals operate control linkages in the hydraulic system of the tractor to keep the sensor in the middle of the plane of light. If the scraper wheels rise when going up higher ground, the scraper is lowered correspondingly which causes the blade to cut the soil to the desired grade.

When driving over low places the same system causes the blade to rise with respect to the wheels to allow soil from the scraper to fill the depressions.

When it is desired to survey the field before leveling, the linkage connecting the receiving sensor to the blade is disconnected which allows the digital counter in the tractor cab to read out the magnitude of the "ups" and "downs" as the tractor drives over field. The sensor may be set to operate at the average reading of the "ups" and "downs"; and with the linkage between the sensor and the blade restored, the equipment is ready to level the field to the average grade.

C. Results Observed In El Minya With Laser Leveling Equipment During April and May 1983: (From an interview with Dr. Nielsen)

1. Laser leveling is absolutely accurate and land can be leveled within one cm consistently. Water applied flows evenly and uniformly over the field. Irrigation time is reduced.

2. A presurvey of fields is not necessary with laser leveling. If cut and fill data are required, the equivalent to the presurvey can be accomplished by observing elevation read outs in the tractor while driving around the field one or two times.

3. Small widths of land (as narrow as 7 meters) can be leveled because the scraper-blade elevation system is completely independent and is not affected by the angle of the scraper tongue and tractor drawbar during turning. Sharp $90^0$ turn are not a problem.

4. One feddan can be leveled in approximately two hours. Leveling and smoothing the same area with regular equipment may require an entire eight-hour day.

5. The optimum field size for minimum earth movement is from ½ to 1 feddan. Larger fields usually require greater volume of soil per feddan to be moved to achieve the final elevation or grade. The field need only be wide enough for the tractor-scraper to turn around.

6. Individual leveling of small farms is much preferred by the farmer because it eliminates the problems of spreading weeds (especially grass roots) and top-soil from farm to farm. Each farmer retains the results from his previous farm management practices.

7. Laser leveling could be done at night as efficiently as in the day time, and three 6 to 7 hour work shifts a day could easily be accomplished. This schedule would allow for maximizing the amount of land that can be leveled in the shortest time. In Egypt where two or three crops are planted per year and there is minimal time between harvests and plantings, this is especially important.

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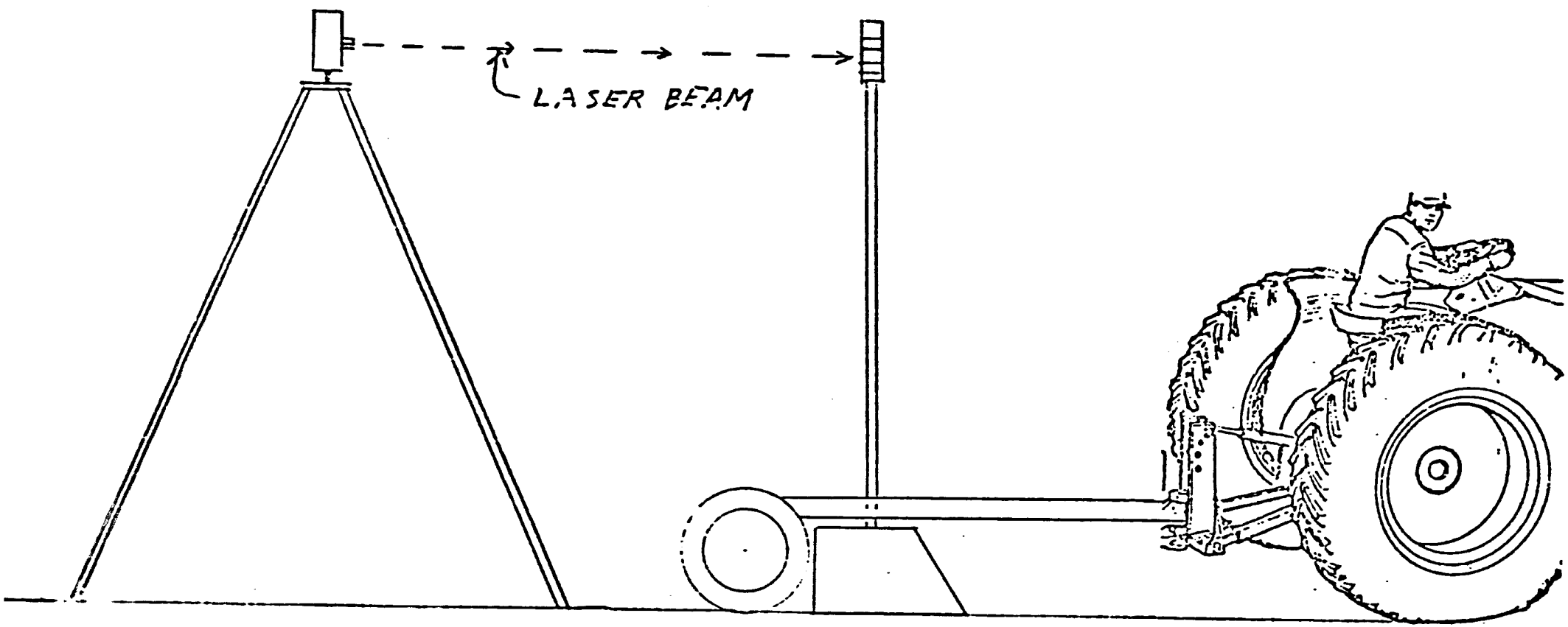
# FIG. 1 LASER LEVELING EQUIPMENT




ROTATING SENDING UNIT ON TOP OF TRIPOD IN FIELD EMITS THIN LASER BEAM

RECEIVING SENSOR ON MAST ATTACHED TO SCRAPER KEEPS SCRAPER BLADE OPERATING PARALLEL TO LASER BEAM

(Draft)

# .ong Border/Furrow Irrigation vs. Small Basin Irrigation

## Summary

Land leveling to prepare land for efficient irrigation with long borders/furrows for comparison with small basin irrigation has been conducted in the Egypt Water Use and Management Project at El-Minya, Mansuriya, and Kafr El-Sheikh.

The land has been leveled with zero slope (dead level) with most of the long runs being 100 to 140 meters long on heavy textured soil. Small basins have ranged between 12 to 45 meters in length.

A concept is presented showing that the larger the non-erosive irrigation stream that is applied to dead leveled land, the higher the water-application efficiency may become if the time of flow is just sufficient for moisture to penetrate to the bottom of the root zone at the downstream end of the borde

Irrigation trials have been made with different measured rates of flow to selected areas planted with berseem, broad beans, wheat, cotton and corn. Moisture stored in the root zone has been measured with soil samples obtained before and after irrigations, and computed water application efficiencies have been plotted with respect to size of stream.

In some irrigation trials, the results indicated that larger streams result in higher water-application efficiencies. However, in many cases the efficiencies are lower. This reversal has been caused by allowing the water to flow unduly long during the irrigations on the newly leveled land.

In many cases there was no appreciable difference in the highest efficiencies of the small basins as compared to the long basins. The important finding here is that long borders can have water-application efficiencies that are as high or higher than those that have been attained in the small basins.

Long borders may be irrigated directly from *mesqas* thus eliminating *marwas* that are required with small basins. Modifications of this type in irrigation systems in the Project have resulted in improved irrigation efficiency.

These irrigation trials demonstrate the importance of providing instructions to teach farmers how to irrigate to take advantage of the benefits that long borders may make available to them. As in the United States where it has been found important to have an extension service to provide continued technical help for farmers, it will also be important to have a similar program in Egypt. Farmers will need help especially where new recommended practices deviate considerably from customs that have been practiced by them for many generations.

EH/mm

## Criteria For Determining Desirable Irrigation Frequencies & Requirements And Comparisons With Conventional Frequencies And Amount Measured By EWUP

### SUMMARY AND CONCLUSIONS

The on-farm irrigation measurements made by the Egypt Water Use Project were examined for the purpose of developing criteria for helping farmers decide when it is time to irrigate and how much to apply at each irrigation. The criterion for when to irrigate was based primarily on tensiometer measurements. The tensiometers indicated that for most crops 7 cm of water could be safely depleted from the soil between irrigations. By the time 8 cm were depleted, some tension measurements were already beyond the recommended maximum. Cotton and wheat are believed to be able to withstand somewhat greater tensions than this,and yet there is some evidence that yields of both cotton and wheat might have been reduced when the farmer permitted slightly higher tensions ~~(Figure 5 and Table 1 for cotton, Figure 26 and Table 2 for wheat)~~ to occur. Therefore, except for permitting a somewhat greater stress period at the beginning and one at the end of the growth cycle for cotton, as recommended by the Ministry of Agriculture based on their research, and a period to permit wheat to mature at the end of its growth cycle, the recommended criterion is to irrigate when 7 cm of water have been depleted from the upper 90 cm of soil.

How to know when 7 cm have been depleted remains somewhat of a problem, since the use of tensiometers is not practical for a farmer with only one feddan. As an alternative, suggested irrigation schedules have been prepared, based on the best available estimates of consumptive use rates of the major crops in each of the three work areas chosen by EWUP. The date of each succeeding irrigation was determined by integrating under the CU curve until another 7 cm had been used. An attempt was made to avoid scheduling an irrigation during the winter closure period, but still some conflicts could appear. It is recognized that there are many possible errors from using this approach, so it is recommended that the irrigation advisors monitor, at least one field in each group of farms following a particular schedule. They would then be in a position to alter the schedule if a problem developed. The suggested schedules developed so far are presented in the respective figures contained in the body of this report. A summary

table ~~(Table 3)~~ contains pertinent information from the best of these schedules. It is obvious from this table that more (and better) schedules need to be developed as more accurate estimates of consumptive use become available, and as more experience is gained from applying these schedules.

The calculated amount to apply at each irrigation is shown in the respective figures, but does not appear in the Table . The amounts were based on an assumed application efficiency of nearly 100% for Mansuriya, 95% for Kafr El-Sheikh, and 85% for Abyuha. These efficiencies were deliberately chosen very high in an attempt to gradually lower the water table during each cropping season. That is one reason why a certain amount of continued monitoring is recommended. Some fields that tend to be sub-irrigated, and those that receive significant rainfall, might need even less, but a few may need more water. If one were to use only the data contained in the Table , one could come close to the correct amount to apply at each irrigation by choosing 7 to 7.5 cm for Mansuriya, 7.5 to 8 cm for Kafr El-Sheikh, and 8 to 9 cm for Abyuha. This assumed that advisors will know the average stream size and can therefore tell the farmer how long his irrigation should continue.

Following the schedules proposed in this report (or their improved sequels as experience with them is gained) should increase yield on those fields that now are occasionally subjected to excessive soil moisture stress. If might even improve yields generally in an area due to a lower water table if all farmers are controlling their applications. It should save water from those farms that are now receiving more than necessary, but part of the saving will go to those that now receive too little. A lower water table should reduce salt migration to the surface, but less applied water would leach less, so the net effect on salinity is not easily predictable. The percentage changes in yield and in water saved will be small but they could each be very significant for the future of Egyptian agriculture.

The present practice of rotation delivery in the canal system does not

SUMMARY TABLE OF PROPOSED IRRIGATION SCHEDULES BELIEVED TO BE THE BEST OF THOSE LISTED IN THIS REPORT.
(THE FIRST IRRIGATION IS INDICATED BY THE PLANTING DATE "FOLLOWING FARMERS' PRACTICES", SUBSEQUENT IRRIGATIONS BY THE NUMBER OF DAYS SINCE THE LAST IRRIGATION)

| | WHEAT | COTTON | BERSEEM | MAIZE | BROAD BEANS | FLAX | VEGETABLES |
|---|---|---|---|---|---|---|---|
| ABYUHA | FIG.7<br>DEC.1<br>26<br>42<br>28<br>22 | FIG.9<br>MAR. 25<br>42<br>19<br>15<br>14<br>13<br>12<br>13<br>15 | | FIG. 12<br>MAY 15<br>17<br>16<br>13<br>11<br>11<br>11<br>13 | FIG. 11<br>NOV. 10<br>45<br>43<br>29<br>21 | | |
| MANSURIYA | FIG 2<br>NOV. 25<br>37<br>31<br>22<br>16<br>15 | | FIG. 17<br>OCT. 15<br>16<br>28<br>36<br>41<br>30<br>25<br>21 | FIG. 19<br>MAY. 15<br>16<br>18<br>15<br>12<br>10<br>11<br>12 | | | FIG. 24<br>JAN. 1<br>35<br>29<br>24(MAR.30)<br>20<br>17<br>14<br>13<br>11<br>10<br>10(JUL.3)<br>10<br>11<br>12<br>13<br>14<br>16<br>18(OCT.5)<br>22<br>29<br>37(JAN.1) |
| KAFR EL-SHEIKH | FIG. 25<br>DEC. 9<br>37<br>41<br>19<br>20 | FIG.27<br>MAR.25<br>42<br>23<br>17<br>14<br>12<br>12<br>13<br>21 | FIG.29<br>NOV.22<br>28<br>47<br>32<br>22<br>18<br>12 | | FIG.31<br>NOV.20<br>26<br>33<br>30 | FIG.30<br>DEC. 6<br>32<br>40<br>22<br>16<br>14 | |

make it easy to follow the proposed irrigation schedules. Most of the schedules have very little cushion to permit a delay from the scheduled date of irrigation. Therefore, until such time as water becomes available on some kind of reliable demand schedule, it may be necessary to add an extra irrigation occasionally, thus partially defeating the advantage of this program. Advisors can keep this problem to a minimum by reducing the amount applied when an irrigation must be made ahead of schedule. Those farmers located near the end of any watercourse have an additional problem of not knowing when, or in some regions even whether, the water will reach their lands during a particular rotation on-period, but this problem can be reduced by greater cooperation in the operation and maintenance of the distribution system. It is therefore recommended that when the austere irrigation schedules suggested in this report are introduced in a particular area, the water delivery capabilities of the distribution system be made as reliable as possible.

# A METHOD FOR EVALUATING AND REVISING IRRIGATION ROTATIONS

R.L. Tinsley, A. Ismail, M. el Kady

## SUMMARY

This paper presents a method of evaluating the efficiency of an irrigation delivery system for small farmers. It focuses on how to determine if the water supply is sufficient, defficient or surplus without determining each individual farmer's daily needs. Instead the method looks at the aggregrate use by the farming community as determined by a farm record sampling. It then relates this to hydraulic information outained from the Water Budget Analysis of inflow, outflow, and water level recorders. The information was then combined to determine possible modifications in the irrigation rotation system.

The case history of Dekalt Canal is used as an example. This is a somewhat unusual canal in that the lower reaches tend to have surplus water. The analysis thus concentrates on identifying when these surpluses occur in a large enough volume so that an adjustment in the irrigation rotation would be feasible, and results in a reduced discharge into the Dekalt. This would also realize the saving where it is still possible to reallocate the water for other parts of the Meet Yazid canal. A revised irrigation rotation was developed that could reduce the number of on days by close to 20%. This was mostly by shortening the 4/4

summer irrigation for rice to more closely follow the farmers' actual practices.

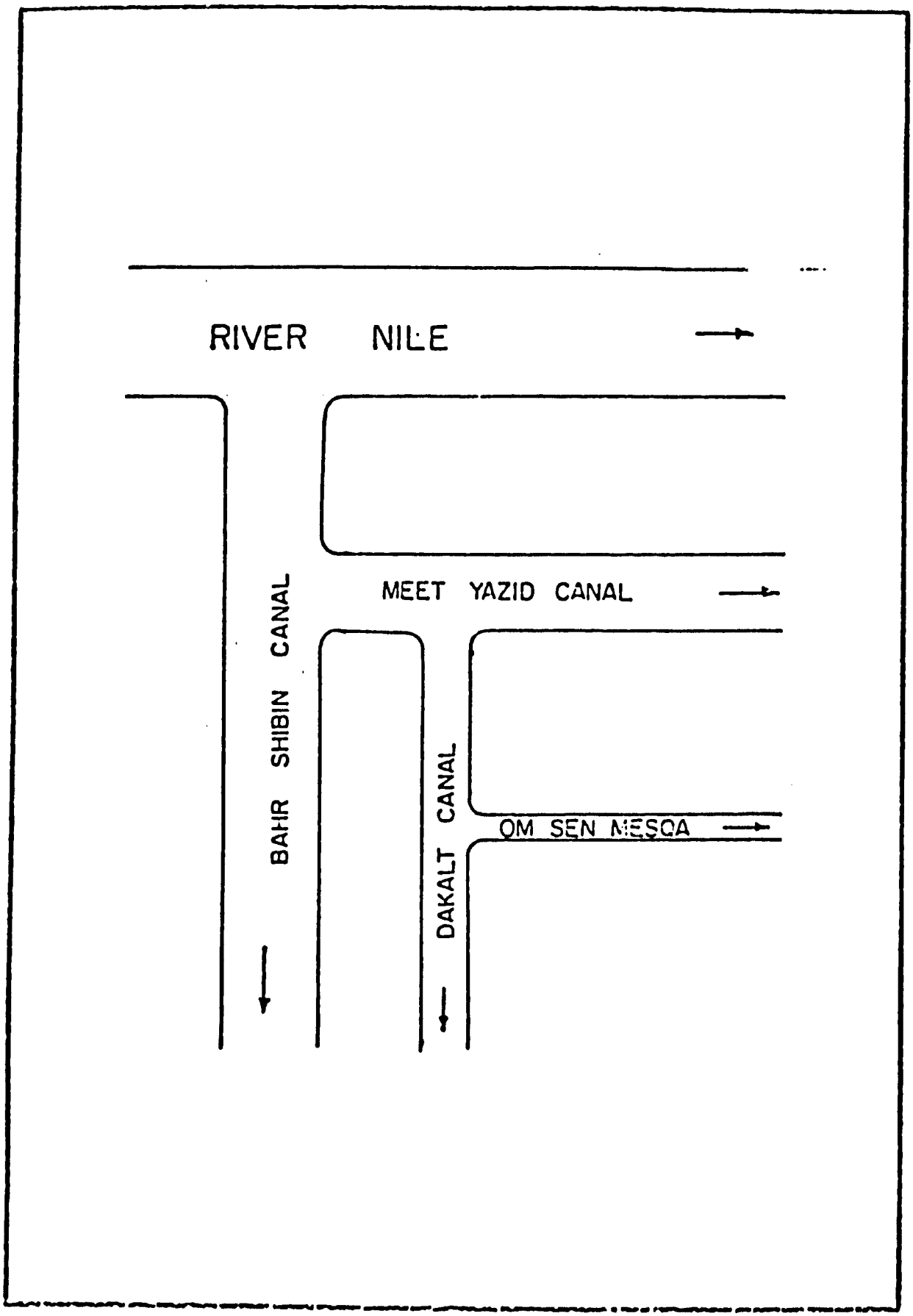
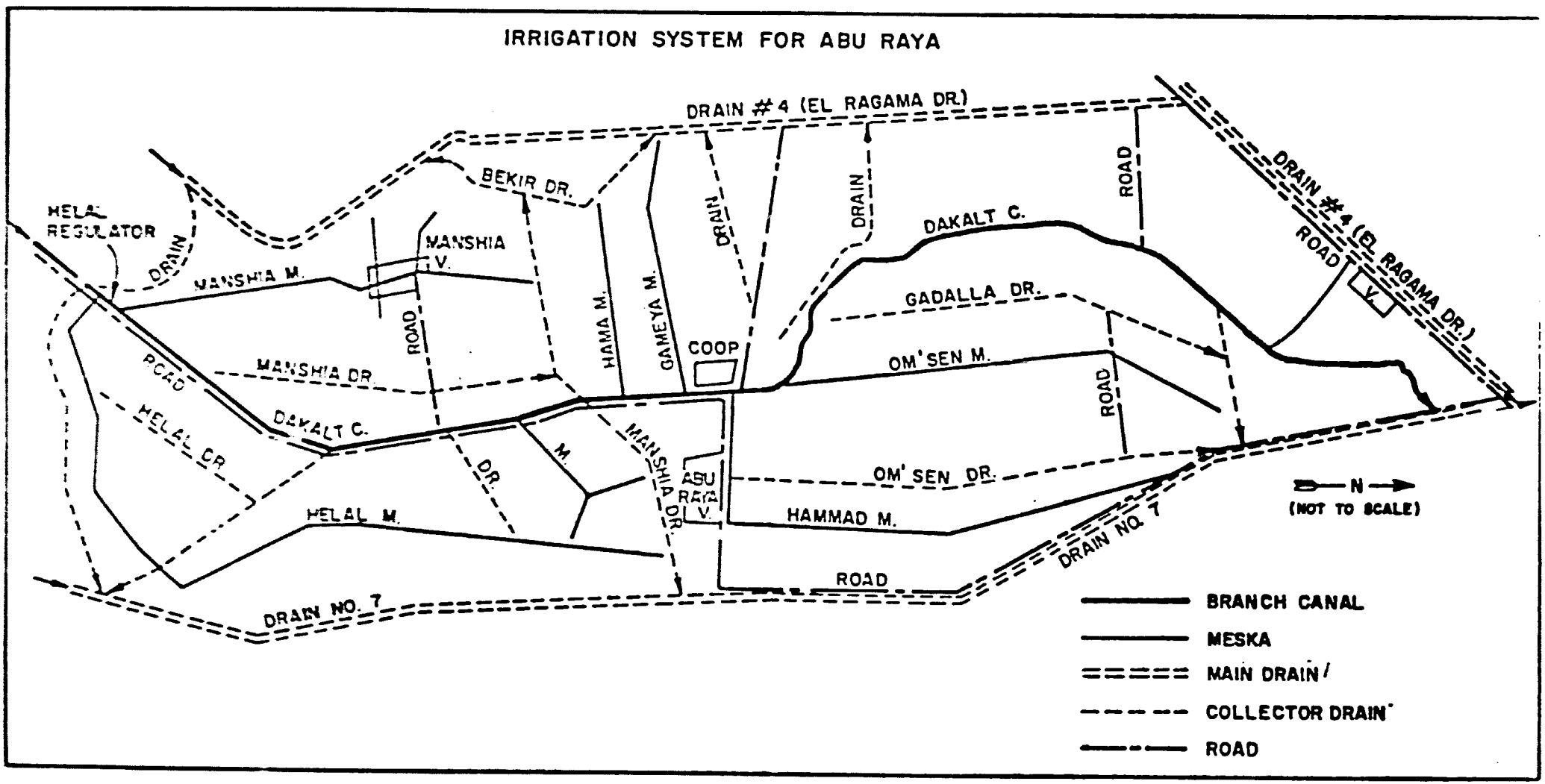
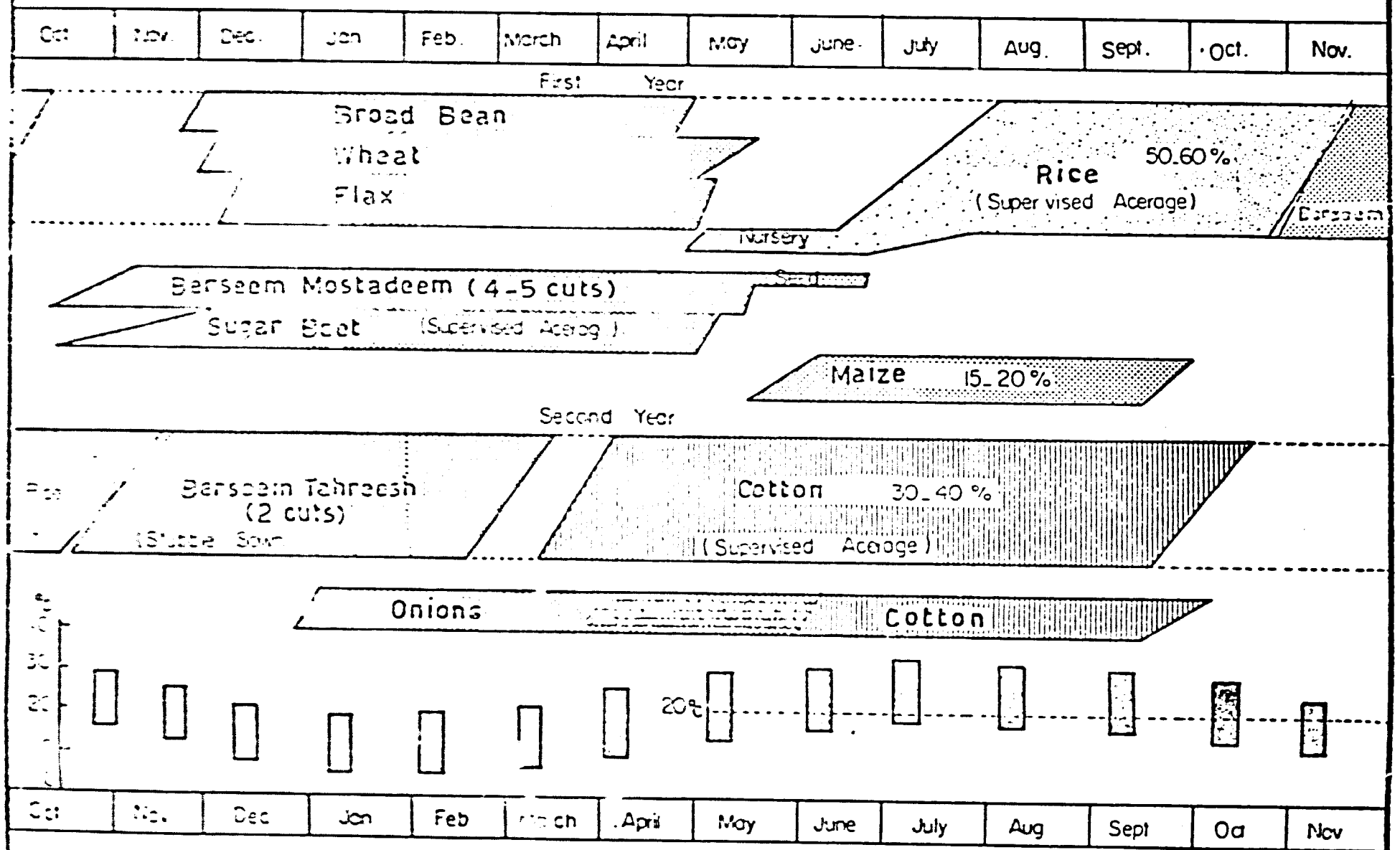


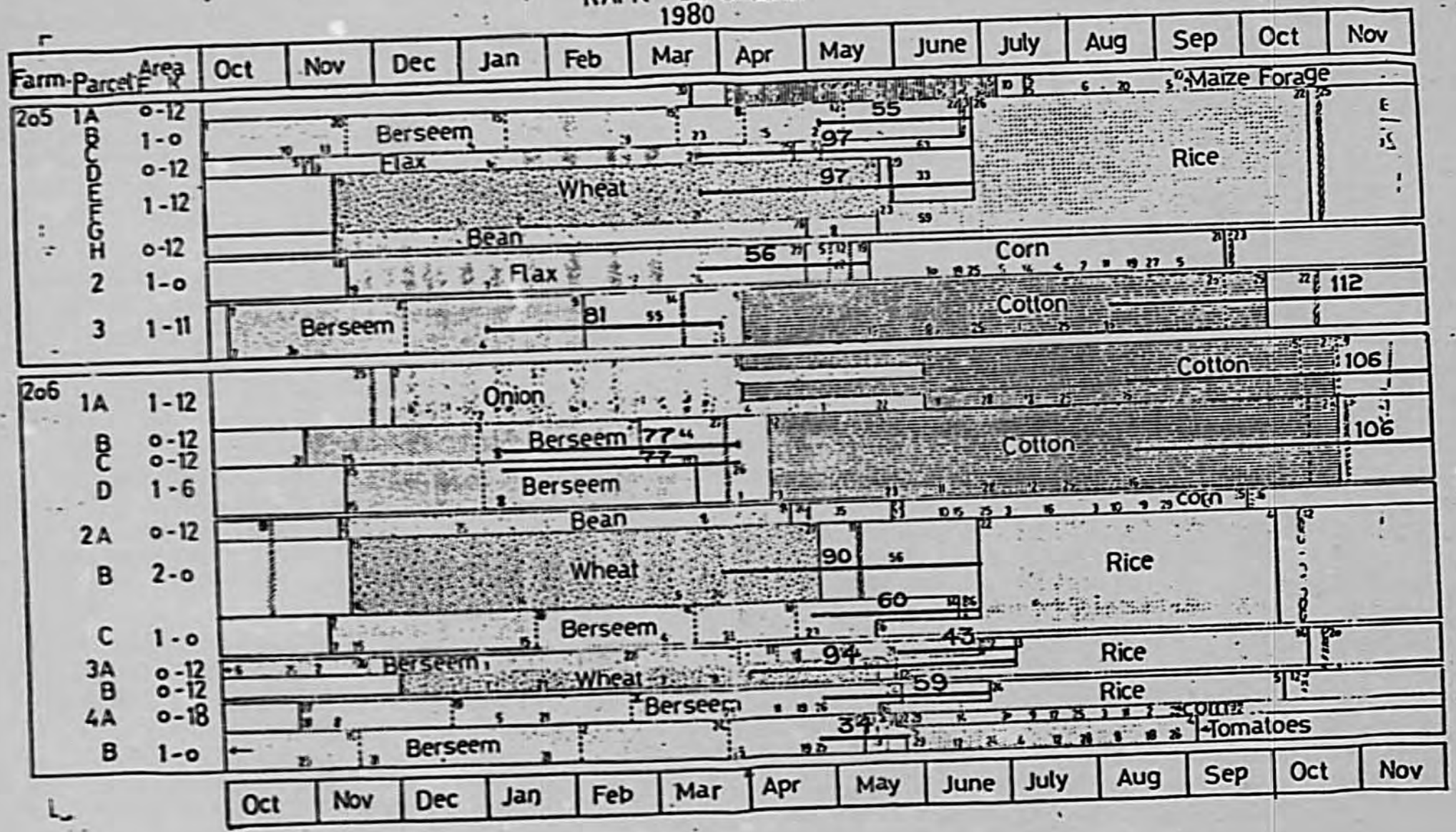

Figure 10. Schematic Of Delivery System For Om Sen


IRRIGATION SYSTEM FOR ABU RAYA
DRAIN #4 (EL RAGAMA DR.)
BEKIR DR.
HELAL REGULATOR
DRAIN
MANSHIA M.
MANSHIA V.
ROAD
HAMA M.
GAMEYA M.
DRAIN
DRAIN
ROAD
DAKALT C.
DRAIN #4 (EL RAGAMA DR.)
ROAD
V.
GADALLA DR.
COOP
OM'SEN M.
ROAD
MANSHIA DR.
ROAD
DAKALT C.
HELAL DR.
DR.
M
MANSHIA DR.
ASU RAYA V.
OM'SEN DR.
HAMMAD M.
HELAL M.
DRAIN NO. 7
ROAD
DRAIN NO. 7
N
(NOT TO SCALE)
BRANCH CANAL
MESKA
MAIN DRAIN
COLLECTOR DRAIN
ROAD

# Cropping Rotation In Abu Raia , Kafr El-Sheikh



# CROPPING PATTERN IN ABU - AYA
## KAFR - EL-SHEIKH
## 1980



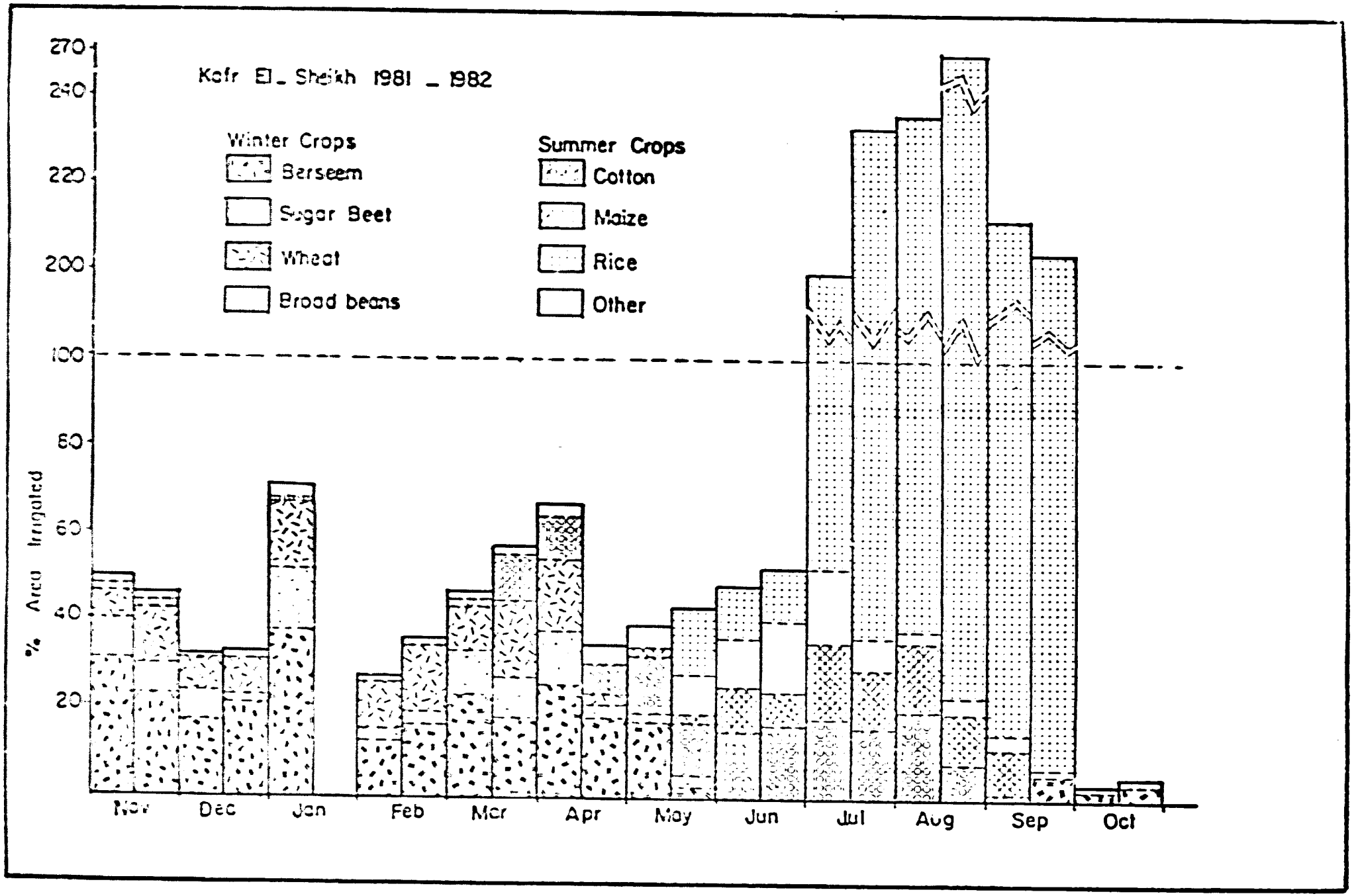

Kafr El_ Sheikh 1981 _ 1982
Winter Crops
Berseem
Sugar Beet
Wheat
Broad beans
Summer Crops
Cotton
Maize
Rice
Other
% Area Irrigated
270
240
220
200
100
80
60
40
20
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

Table . Summary of Dekalt Hydraulic Data: October 1981 to September 1982 DEKLT1/2

| Month | Days | Om Sen | | | | | D.S. Hamad Inlet | | Dekalt Tail | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Inflow | %Annual | Outflow | % Annual | Out/Inflo | TH^3/2 | % Annual | TH^3/2 | % Annual |
| | | M^3 | | M^3 | | % | | | | |
| OCTOBER | 1-15 | 197623 | 5.24 | 176012 | 9.40 | 89.06 | 2942.20 | 13.63 | 486.40 ? | .48 |
| | 16-31 | 107316 | 2.85 | 99250 | 5.30 | 92.48 | 467.60 ? | 2.17 | 283.60 ? | .28 |
| NOVEMBER | 1-15 | 134750 | 3.57 | 80046 | 4.27 | 59.40 | 353.30 | 1.64 | 455.40 ? | .45 |
| | 16-30 | 239771 | 6.36 | 90407 | 4.83 | 37.71 | 1435.60 ? | 6.65 | 6288.90 | 6.16 |
| DECEMBER | 1-15 | 193772 | 5.14 | 42115 | 2.25 | 21.73 | 64.00 ? | .30 | 2274.40 | 2.23 |
| | 16-31 | 189731 | 5.03 | 23663 | 1.26 | 12.47 | .00 ? | .00 | .00 ? | .00 |
| JANUARY | 1-15 | 308526 | 8.18 | 11723 | .63 | 3.80 | 1755.46 ? | 8.13 | .00 ? | .00 |
| | 16-31 | 165265 | 4.38 | 2647 | .14 | 1.60 | 2.00 | .01 | .00 | .00 |
| FEBURARY | 1-14 | 166080 | 4.40 | 6217 | .33 | 3.74 | .00 | .00 | 7981.89 | 7.82 |
| | 15-28 | 147511 | 3.91 | 29828 | 1.59 | 20.22 | .00 | .00 | 5065.67 | 4.96 |
| MARCH | 1-15 | 149138 | 3.95 | 55755 | 2.98 | 37.38 | 19.80 ? | .09 | 2024.74 ? | 1.98 |
| | 16-31 | 171370 | 4.54 | 81425 | 4.35 | 47.51 | 829.06 | 3.84 | 6038.95 ? | 5.92 |
| APRIL | 1-15 | 139428 | 3.70 | 73254 | 3.91 | 52.54 | .00 | .00 | 1420.65 | 1.39 |
| | 16-30 | 103523 | 2.75 | 69560 | 3.71 | 67.19 | .00 ? | .00 | 4920.42 ? | 4.82 |
| MAY | 1-15 | 82209 | 2.18 | 59099 | 3.16 | 71.89 | .00 | .00 | 21604.30 | 21.17 |
| | 16-31 | 152740 | 4.05 | 85875 | 4.59 | 56.22 | 327.70 | 1.52 | 6998.30 | 6.86 |
| JUN | 1-15 | 124768 | 3.31 | 75421 | 4.03 | 60.45 | 5126.37 | 23.75 | 9822.29 | 9.63 |
| | 16-30 | 161165 | 4.27 | 121810 | 6.50 | 75.58 | 294.10 | 1.36 | 992.31 | .97 |
| JULY | 1-15 | 168914 | 4.48 | 207556 | 11.08 | 122.88 | 1798.96 | 8.33 | 4662.11 ? | 4.57 |
| | 16-31 | 185675 | 4.92 | 152157 | 8.12 | 81.95 | 2167.22 | 10.04 | 8228.91 | 8.06 |
| AUGUST | 1-15 | 130730 | 3.47 | 79803 | 4.26 | 61.04 | 497.10 | 2.30 | 2253.56 | 2.21 |
| | 16-31 | 111927 | 2.97 | 116707 | 6.23 | 104.27 | 1117.38 | 5.18 | 4048.75 | 3.97 |
| SEPTEMBER | 1-15 | 131703 | 3.49 | 82264 | 4.39 | 62.46 | 1727.63 | 8.00 | 2312.30 | 2.27 |
| | 16-30 | 107578 | 2.85 | 50150 | 2.68 | 46.62 | 660.29 ? | 3.06 | 3880.35 | 3.80 |
| Annual Totals | | 3771213 | 100.00 | 1872744 | 100.00 | 49.66 | 21585.97 | 100.00 | 102044.20 | 100.00 |

? Indicates mechanical problems occured for extended period during the time period, mechanical problem include clocks stopping, floats being jammed, etc.

Table 1A. "On" Periods for Dekalt Canal - Oct.'81 to Sept.'82.

| | October | | | November | | | December | | | January | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inferred | | | Inferred | | | Inferred | | | Inferred | |
| Day | Sch | Ham | Dek | Sch | Ham | Dek | Sch | Ham | Dek | Sch | Ham | Dek |
| 1 | | | | | | | on | | on | | | |
| 2 | | | | | | | on | | on | | | |
| 4 | | | | | | | | | on | | | |
| 5 | on | on | on | | | | | on | on | | | |
| 6 | on | on | on | on | on | on | | on | on | | | |
| 7 | on | on | on | on | on | on | | on | on | on? | | |
| 8 | on | on | on | on | on | on | | on | on | on? | | on |
| 9 | | on | on | on | on | on | | on | on | on? | | on |
| 10 | | on | on | | on | on | | on | on | on? | | on |
| 11 | | on | | | on | | | on | on | on? | on | on |
| 12 | | | | | | | on | on | on | close | on | |
| 13 | on | on | | | | | on | | on | close | on | |
| 14 | on | on | | | | | on | | | close | on | |
| 15 | on | or | | | | | on | | | close | on | |
| 16 | on | on | | | | | | | | close | | |
| 17 | | on | | | | on | | | | close | | |
| 18 | | | | on | on | on | | ? | | close | | |
| 19 | | | | on | on | on | | ? | | close | | on |
| 20 | | | on | on | on | on | | | | close | | on |
| 21 | | | on | on | on | on | | | | close | | on |
| 22 | | on | on | | on | on | | | | close | | on |
| 23 | | on | on | | on | on | | | ? | close | | |
| 24 | | | | | on | on | on | | ? | close | | |
| 25 | on | | | | | on | on | on | ? | close | | |
| 26 | on | | | | on | on | on | on | | close | | |
| 27 | on | | | | on | on | on | ? | | close | | |
| 28 | on | on | | | on | on | | | | close | | |
| 29 | | on | | | | on | | | | close | | |
| 30 | | | | on | | on | | | | close | | |
| 31 | | | | -- | -- | -- | | | | close | | |
| Total | 12 | 16 | 10 | 9 | 16 | 19 | 11 | 10? | 13? | 5 | 5 | 7 |

Table 18. "On" Periods for Dekalt Canal - Oct.'81 to Sept.'82.

| | Feburary | | | March | | | April | | | May | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inferred | | | Inferred | | | Inferred | | | Inferred | |
| Day | Sch | Ham | Dek | Sch | Ham | Dek | Sch | Ham | Dek | Sch | Ham | Dek |
| 1 | close | | | on | on | ? | on | | | on | ? | ? |
| 2 | close | | | on | on | ? | on | | | on | ? | on |
| 3 | close | | | on | on | ? | on | | | on | ? | on |
| 4 | close | | | on | on | ? | on | | | | ? | on |
| 5 | close | | | on | on | ? | on | | | | ? | on |
| 6 | close | | | on | on | on | on | | on | | ? | on |
| 7 | close | | | | on | on | on | on | on | | ? | on |
| 8 | close | | on | | | on | on | on | on | | ? | on |
| 9 | close | | on | | on | on | on | on | on | | ? | on |
| 10 | close | | on | | on | on | on | on | on | | ? | |
| 11 | close | | on | | on | on | on | on | | | ? | |
| 12 | close | | on | | ? | on | on | on | | | ? | |
| 13 | close | | on | | ? | | on | on | on | | ? | |
| 14 | close | | on | | ? | | on | ? | on | on | ? | |
| 15 | 1/2 | | on | | | | on | ? | on | on | ? | on |
| 16 | 1/2 | | on | | | | on | ? | on | on | ? | on |
| 17 | 1/2 | | on | on | on | on | on | ? | on | on | ? | on |
| 18 | 1/2 | | on | on | on | on | on | ? | on | on | ? | on |
| 19 | 1/2 | | on | on | on | on | | ? | on | | ? | on |
| 20 | on | | on | on | on | on | | ? | | | ? | |
| 21 | on | on | on | on | | | | ? | | | ? | |
| 22 | on | on | on | on | | | | ? | | | ? | |
| 23 | on | on | | on | | | | ? | | on | ? | on |
| 24 | on | on | | on | on | | | ? | | on | ? | on |
| 25 | on | on | on | on | on | | | ? | ? | on | ? | on |
| 26 | on | on | on | on | on | on | | ? | ? | on | ? | on |
| 27 | on | on | | on | on | on | | ? | ? | | | on |
| 28 | on | on | | on | on | on | | ? | ? | | | |
| 29 | -- | -- | -- | on | | on | on | ? | ? | | | |
| 30 | -- | -- | -- | on | | on | on | ? | ? | | | |
| 31 | -- | -- | -- | on | | on | -- | -- | -- | on | on | on |
| Total | 11.5 | 0 | 17 | 21 | 19+ | 17+ | 20 | 7+ | 12+ | 13 | ? | 19 |

Table 1C. "On" Periods for Dekalt Canal - Oct.'81 to Sept.'82.

| | June | | | July | | | August | | | September | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inferred | | | Inferred | | | Inferred | | | Inferred | |
| Day | Sch | Ham | Dek | Sch | Ham | Dek | Sch | Ham | Dek | Sch | Ham | Dek |
| 1 | on | on | on | | | | | | | | | |
| 2 | on | on | on | on | | | | | | | | |
| 3 | on | on | on | on | ? | | on | | | | | |
| 4 | | | on | on | | | on | on | on | on | on | on |
| 5 | | | on | on | on | | on | on | on | on | on | on |
| 6 | | | | | on | ? | on | on | on | on | on | on |
| 7 | | | | | on | ? | | | on | on | on | on |
| 8 | on | on | on | | | ? | | | | | on | |
| 9 | on | on | on | | | ? | | | | | | |
| 10 | on | on | on | on | on | on | | | | | | |
| 11 | on | on | on | on | on | on | on | on | on | | | |
| 12 | | on | on | on | on | on | on | on | on | on | on | |
| 13 | | | | on | on | on | on | on | on | on | on | on |
| 14 | | | | | | on | on | on | on | on | on | on |
| 15 | | | | | | | | on | on | on | on | on |
| 16 | on | on | on | | | | | | on | | | on |
| 17 | on | on | on | | | | | | | | | on |
| 18 | on | on | on | on | on | | | | | | | |
| 19 | on | on | on | on | on | on | on | | on | | | |
| 20 | | | | on | on | on | on | on | on | on | on | on |
| 21 | | | | on | on | on | on | on | on | on | on | on |
| 22 | | | | | | on | on | on | on | on | on | on |
| 23 | | | | | | | | on | on | on | on | on |
| 24 | on | | | | | | | | | | | |
| 25 | on | on | | | | | | | | | | |
| 26 | on | on | | on | on | on | | | | | | |
| 27 | on | on | | on | on | on | on | | | | | |
| 28 | | | | on | on | on | on | on | on | on | on | on |
| 29 | | | | on | on | on | on | on | on | on | on | on |
| 30 | | | | | on | on | on | on | on | on | on | on |
| 31 | -- | -- | -- | | | | | | on | -- | -- | -- |
| Total | 15 | 15 | 14 | 16 | 17 | 15 | 16 | 15 | 19 | 15 | 16 | 16 |

# POTENTIAL FOR IRRIGATION SCHEDULING

R.L. Tinsley and M. el Kady

## SUMMARY

This is the third in what should eventually be a series of four papers that are based on a "bottoms-up" analysis of the actual farmers' irrigation practices. The four papers are:

1. Farmers' Irrigation Practices in Abuaba, Minya and Abu Raya, Kafr el Shiekh. This paper is nearly completed in final form and will be presented at another session of this Workshop.

2. A Method for Evaluating and Revising Irrigation Rotations. This paper is in draft form still in need of revision. It will also be presented during another session of this workshop.

3. The Potential for Irrigation Scheduling in Egypt. This is the present paper which is still primarily in the outline stage.

4. The Operation and Management of Irrigation Canals in Egypt. This paper is still being conceptualized.

This current paper on irrigation scheduling is designed to examine what is the lowest level feasible for the MOI to become involved in scheduling or regulating the irrigation water. The paper basically looks at the administrative manpower need to schedule

water at different levels from the Aswan High Dam to the individual farmer's field. The underlying question is at what operational level is the gain in irrigation efficiency no longer worth the additional administrative cost required to obtain the efficiency gain.

The paper begins with the proportional distribution of water from Aswan through the various barrages and main canal systems. It then quickly jumps to the distributary canal system on which EWUP has worked and examines how equitable the water is made available to the farmers at various locations within the distributary system. It then looks at how efficiently the farmers utilize the water they receive, and to what extent any excessive water use is voluntary or involuntary It then examines the various times EWUP has become involved in individual farmer irrigation scheduling, such as Mesqa 26 in el Minya, and mesqas 6 & 10 in Mansouria. This provides information on some of the farmer decision making as to when he will irrigate as it relates to other crop needs such as assuring trafficability for a planned harvest, or need to incooperate fertilizer The final evaluation is the question if the amount of water saved by individual farmer scheduling is worth the cost administering and if the manpower needs to do farmer schedule are or could be made available. What other alternative for increasing irrigation efficiency are available.

Table 1. Distribution of Water Among 9 Farms in Abuha Mesga

| Mesga | Farm | Crop | # Irri. | Ave. Q L/sec. | Ave. D cm. |
|---|---|---|---|---|---|
| 13 | Middle | Wheat | 6 | 10.5 | 7.9 |
| | End | Wheat | 7 | 12.3 | 8.2 |
| 22 | Head | B.Beans | 4 | 12.8 | 8.4 |
| | Middle | Wheat | 7 | 13.1 | 9.7 |
| | End | Wheat | 7 | 13.5 | 10.8 |
| 26 | Head | B.Beans | 4 | 15.7 | 12.9 |
| | Middle | Wheat | 6 | 15.5 | 11.7 |
| | End | Wheat | 6 | 6.6 | 9.0 |

Source: Unpublished data of M. Awad

Table 2. Frequency of Irrigation on Mesgua 6-Beni Magdul

| Sagia | Crop | No. Fields | Ave.# Irri. | Days from Irri 1-2 | Ave. days 2-Last |
|---|---|---|---|---|---|
| 1 | Maize | 22 | 7.3 | 20 | 10 |
| | Sunfl | 2 | 5.5 | 25. | 28 |
| | Vegta | 2 | 6.5 | 10 | 10 |
| 2 | Maize | 20 | 6.5 | 15 | 10 |
| | Sunfl | 4 | 4.3 | 20 | 22 |
| | Vegta | 9 | 8.6 | 15 | 9 |
| 3 | Maize | 13 | 6.5 | 20 | 13 |
| | Sunfl | 8 | 3.6 | 30 | 28 |
| | Vegta | 9 | 6.9 | 13 | 11 |

Source: Unpublished data from Sabah Mahmoud

EWUP/D R A F T
28 May, 1983

# COMPUTER ASSISTED DESIGN AND EVALUATION PROCEDURES FOR WATERCOURSE IMPROVEMENT

## PURPOSE

An efficient set of procedures were developed which make use of limited manpower to design watercourse system networks in Egypt. Computer programs were developed, whenever practical, to facilitate implementation of the procedures. This set of procedures, as developed, was denoted as the "Computer Assisted Design and Evaluation Procedures" (CADEP). The seven steps of the procedures, the associated computer programs, the assumptions made in their development, and suggestions for their application are presented.

## SUMMARY

The full potential of Egypt's agriculture cannot be realized without significant improvement and modernization of the distribution of the Nile's water and its application to the crops of the Egyptian farmers. EWUP's research has shown that the watercourse system networks are in need of major repair and maintenance. However, the design of an improved system for use of modern irrigation methods must take into consideration improved on-farm irrigation, farmer access to fields, mechanization, and other agronomic practices.

The design of watercourse improvements for the Egypt Water Use and Management Project activities proved to be complex. In the process a more efficient set of procedures (CADEP) was formalized which capitalizes on the utilization of limited manpower and the computer in the design of small watercourse projects.

The organizational structure envisioned for CADEP in two

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tiered : a general supervisory group at the national level and project implementation teams at the regional levels. The regional teams will need to work closely with the Ministry of Irrigation officials at the Governorate and District level and with local water users groups. The regional CADEP team should be concerned with the application of general principles to the design and evaluation of irrigation improvement projects for specific sites while the national group should be more concerned with delineating the appropriate general principles and reviewing the work of the regional team to make certain it is consistent with the general principles which guide the overall program.

A preliminary survey of an area precedes the implementation of CADEP. The results from an area assessment are used in determining the extent of improvement (maintenance, complete re-design, or none, etc.) required.

The Computer Assisted Design and Evaluation Procedures (CADEP) are (1) survey the existing water course system to be investigated, (2) analyze and summarize the survey data, (3) calculate the hydraulic characteristics for a specified water delivery scheme, (4) design improved watercourse characteristics for specified alternatives, (5) determine the construction scheme for each specified alternative, (6) evaluate the specified alternatives, (7) develop preliminary working (construction) drawings for the alternative(s) selected in (6). These procedures are applied to watercourse system networks which consist of a secondary distribution canal serving several farm channels from which farms are directly irrigated. Key to CADEP is the specification and evaluation of design alternatives.

# HYDRAULIC DESIGN OF A CANAL SYSTEM FOR GRAVITY IRRIGATION AT ABYUHA

## SUMMARY

Abyuha region is about 20 km south of El-Minya. Its 1200 *feddans* are serviced by the 4000 meter long Abyuha canal, a branch of the Ibrahimiya canal. Thirty *mesqas* receive water from Abyuha canal. Presently, about 60 percent of the region can be irrigated by gravity. *Tambours* or diesel centrifugal pumps serve the rest. Could the entire region be irrigated by gravity? The study to answer to this question led to the design of a gravity system for Abyuha. More importantly, it produced a generalized computer model and procedure for the design of any similar system.

The workings of the model are illustrated by using the Abyuha region for an example.

## PRELIMINARY INVESTIGATION

Small stream sizes were a major problem with the present system. A study of the water levels in the Ibrahimiya canal showed that head needed for adequate stream sizes would be available if the banks of the Abyuha canal were raised. Improved channels and adequate turnouts would be required to use the head effectively.

The Ibrahimiya canal water level varied with season following a sinusoidal pattern with a high in July and a low in October. With respect to the average land elevation, the available heads were 0.8 and 0.1 meters respectively. Since the need for water would be at a high in July and at a low in October, gravity irrigation seemed feasible for most of the year.

The water demand was determined by applying consumptive use data from the ARE Water Master Plan Technical Report No. 17 to the crop surveys

for the summer and winter seasons. Dividing by an irrigation efficiency of 0.63 and adding 10% for other losses established the volume of water to be delivered to the region each month.

FLOW RATES

The average required flow rate into the Abyuha canal was calculated by dividing the monthly volume by the flow duration during the month. An earlier study indicated that an acceptable system would be flow every day for 12 hours (daytime). For the Abyuha canal the required flow rates ranged from 178 liters per second in October to 1452 liters per second in July.

THE ROTATION

In order to have stream sizes large enough for good irrigation application efficiency, the flow in the distribution canal was diverted to successive groups of *mesqas*, each group receiving water in turn. If the average total flow rate was small the number of *mesqas* in the group was small. For example, in October a flow of 178 liters per second was diverted to *mesqas* serving one-fifth of the area. Each *mesqa* in the group received 5 times its aliquot flow rate for one-fifth of the time. In July, when the flow rate was 1452 liters per second, the *mesqas* were divided into two groups for receiving flow. For other months the rotations were set to meet the need.

HYDRAULIC DESIGN

The design begins with the last field on the last *mesqa*, the furthermost point in the region. The irrigation rate is selected, generally 20 liters per second per field turnout. A turnout type is chosen — pipe, siphon tube, or bank cut. The head loss through the turnout is calculated by the pertinent hydraulic laws and added to the water surface elevation on the field (0.12 meters above field surface) to obtain the

water surface elevation in the *mesqa*. Proceed upstream in the *mesqa* calculating the water surface profile to obtain the water surface elevation immediately downstream of the next open turnout. Calculate the elevation drop due to momentum change to determine the water surface elevation immdediately upstream. This elevation minus the water surface elevation on the field is the available head on the turnout. Determine the size of the turnout required to pass the design discharge of the available head. Select the nearest commercial size and calculate the actual discharge or determine a gate setting for a larger turnout. The entire process requires iterative trial and error computations too involved to describe in this brief summary. Details are in the comprehensive report.

A similar design process takes place in the distribution canal, but now it is the size of vent that is being determined. Calculations are brought upstream to the head of the canal and finally to the required water level in the Ibrahimiya canal. If the calculated water surface profile at the entrance gate is below the level of the Ibrahimiya canal the required flow is attainable and the design is satisfactory. If it lies above, the design is examined for changes in the system which would lower the hydraulic grade line. This could be done, for example, by reducing the friction factor in the highest *mesqa* to reduce the turnout head requirement and at the same time lowering the hydraulic grade line in the canal by increasing the size of the control turnout -- the last open turnout to a *mesqa* along the canal.

DESIGN PROCEDURES

A. Collect data on:

1. Farm field length, width and surface roughness. Type of irrigation.
2. Topographic surveys.
3. Cross-sections of Abyuha canal and the *mesqas*.
4. Location of *mesqas*, structures, bends, cross-section changes on Abyuha canal.

5. Location and types of turnouts, locations of other hydraulic features on *mesqa*.
6. Hydraulic parameters for structures or controls along the canal or *mesqas*.
7. Water surface elevation in the Ibrahimiya canal throughout the year.
8. Cost Estimates for materials and construction.

B. Determine the design controls. At the lower end these were the elevations of the water surface at the head of the fields serviced by each *mesqa*. This was judged to be 0.12 m above the high ground elevation. At the upper end the control was the water level in the Ibrahimiya canal.

C. Make a preliminary design based on the initial choice of hydraulic parameters. With this design as a guide and with practical considerations a constraint, select *mesqa* cross-sections and slopes and turnout types. Except for two lined *mesqas* the channels and canal would be earth with Manning n equal to 0.04. Values of Manning n of 0.06 and 0.08 were used to study the effect of maintenance or lack, therefore, on system operation.

DESIGN OUTPUT

The finished product is a complete hydraulic design. Specification sheets are provided for each *mesqa* and for the canal which list the hydraulic dimensions and parameters, the type, number and size of turnouts, and the characteristics of structures for measurement and control. Plots of water surface profiles in each *mesqa* and in the canal are also provided. This information is then used to prepare detailed structural specifications.

(Draft)

# MINYA PILOT PROGRAM

## SUMMARY

### I. Introduction:

Abyuha area is about 1200 feddans, belonging to farmers at Abyuha and Kom El-Zoheir Villages. This area is served by Abyuha Canal which bonds the area from the east, and the two drains of Kom El-Zoheir from the North and West. About $\frac{2}{3}$ of this area irrigates by gravity under head from 8 - $10^{3}$cms (poor gravity), the rest of the area irrigates by lifting (using a Tambour or pumping machine).

### II. Problem Identification:

The study and analysis of the data collected by the Minya Team has led to the identification of the following problems:

A. Irrigation System:

- The inlet of Abyuha Canal is controlled by wooden blocks which allow more leakage during the off-period.
- All the *meaqa* inlets do not have head gates for water control, most of them have no legal pipes and some of them are fed by cuts in the canal banks.
- The canal banks cannot be used for the passage of any machine.
- The canal stream is not straight having 5 sharp bends which affect the discharge of the canal.
- All the ends of the *meaqaa* are open directly to the drains such that the western drain is usually full of water specially during the on-period, and overflows to the adjacent land. It is thus ineffective in drainage of the excess water.

- By means of the water budget of Abyuha area, the quantity of water lost in drains from the canal discharge was measured to be about 35%.
- There is neither organization nor cooperation between the farmers on the *mesqas* during irrigation. Most of them try to make mud dams to raise the water level in front of their farms which prevent others at the tail ends from irrigating during on-periods. Also, there is no cooperation between them in cleaning and maintaining the *mesqas*

B. On-Farm Irrigation:

- The farmers try to irrigate from both sides as the land is not leveled. These *mesqas* occupy about 50 *feddans* from the area.
- The area which irrigates by gravity requires more time (about 6 hours per *fed*.) due to the lower head in the *mesqas* (about 10 cms head).
- The area that irrigates by lifting (using tambour) also requires more time in addition to the expenses of irrigation which range from about L.E. 50 - 70 per *fed*/year.
- The farmers try to divide their lands into basins in order to prevent the uneven distribution of water due to unleveling.
- There are no internal roads to allow the accessibility of farm machinery to the farmers' lands and it is thus more expensive for the farmers to transfer their production outside the land.

C. Land Studies:

- From the soil fertility samples it was observed that:
  a. There is a deficiency of zinc in all the area.
  b. There is some alkalinity in the land due to the flooding of drains and seepage from *mesqas*.

- All the area should be leveled.
- The water table level is about 1.5 - 2m deep from the land surface.

## III. Accomplishments and Work Plan:

### A. *Meaqa* Improvement Models:

1. *Meaqa #26:*

   - Filling and redigging of the *meaqa* in a straight line, dividing it into three reaches by check structures.
   - Elimination of the cuts in the two banks (102 cuts) and making 20 outlets with iron head gates and pipes (20 cm in diameter) under the banks.
   - A sharp-edged weir at the inlet of the *meaqa* allows the measurement of the water delivered to it and facilitates making the *meaqa* water budget.
   - Organization of the farmers on this *meaqa* to cooperate with each other in carrying out the irrigation schedule and cleaning the *meaqa* under the leader's supervision.

2. *Meaqa #7:*

   - Filling and redigging of the *meaqa* in a straight line.
   - The farmers were left to irrigate by cuts, but they used "canvas dams" instead of mud dams to raise the water in front of their farms.

3. Eliminating *Meaqa #9:*

   - After leveling the area between *Meaqaa* #7 & #9 and between *Meaqaa* #11 & #9, we convinced the farmers to irrigate from one side. Then *Meaqa* #9 was eliminated and filled and a road was constructed to facilitate the passage of machines between *Meaqaa* #7 & #11.

B. Experiments Conducted in the Area:

- Experiments were conducted on the summer and winter crops by adding zinc sulphate, and comparing the production in the same farm while keeping all conditions constant. An increase in the production by adding zinc sulphate was noticed in all the crops ranging from 15% to 30%.
- Measuring the quantity of water applied on-farm before and after leveling in case of summer and winter crops proved that 9% to 15% of the water is saved after leveling.
- Measurement of the water budget of Abyuha area by placing a flume on the canal and the two drains by which the percentage of water delivered to the drains from the Abyuha Canal discharge was determined to be about 35%.
- Seepage experiments were conducted on M # 7 and M # 26 from which the percentage of seepage from the *Meaqa* discharge was found to be very small.

C. Abyuha Canal and *Meaqa* Improvement:

- An iron head gate was installed at the canal inlet and the water was controlled during the off-period.
- The canal stream was modified specially at the bends to save the loss of head.
- A road was constructed on the left bank to facilitate transportation.
- The inlets of all *meaqaa* were constructed by building adequate pipes and iron head gates to control the water on each *meaqa* and organize the rotation on the *meaqaa* and the continuous flow on the canal, by the help of leaders chosen for *Meaqaa*.
- The contractor is assigned to improve all the *meaqaa* according to the previous models. Two of them will be lined with

pipes and gates at the outlets, the other two will be earth section with pipes and gates at the outlets, and the rest of the *meaqaa* will be earth sections with cuts.

- Some of the area was previously leveled by the field plane. At present leveling is continued with the help of the Mechanization Project. Up till now about 200 *fed.* were leveled.
- By the agreement and cooperation between farmers, a road was constructed on the border between *maaqaa* #25 and #26.
- The contractor will construct a tail escape at the end of each *meaqa* to control the water delivered to the drains.
- After land leveling is over, it is planned to eliminate some of the *meaqaa* and construct roads to help the accessibility of farm machinery and equipment.
- The leaders of the *meaqaa* are supposed to take the responsibility of organizing the irrigation process and maintaining and cleaning the *meaqaa* under the Project's supervision.

*AR/mm*

(DRAFT)

# MANSURIYA PILOT PROGRAM

## 1. Introduction:

Mansuriya area is one of three sites selected by the Egypt Water Use and Management Project (EWUP) for demonstrating problems and their solutions. It was the first area in which the Project started its activities for the following reasons:

1. It represents the agricultural areas near cities.
2. Some activities had already begun there before the Project started and some records and data helped EWUP staff in its initial phase.

## II. Description of The Area:

Mansuriya is the name of the main canal that supplies the district with irrigation water in Giza Governorate. The Project activities were concentrated in two areas:

Beni Magdul and El-Hammami.

### A. Beni Magdul Area:

It is about 770 *feddans*. Beni Magdul canal and its branch, taking their water from Mansuriya canal, are the main sources of water to the area. This water is supplemented at peak demand times by pumping water from the drains and wells. Beni Magdul canal was lined by concrete in 1977 and water is put under control by a special type of gates (constant discharge gates with one buffle). The water is on a continuous flow basis into the canal regulated according to the water requirements. The corps growing there are berseem, wheat, winter vegetables, corn and summer vegetables. The soil is mostly clay to clay-loam.

### B. El-Hammami Area:

El-Hammami canal serves about 800 *feddans*. This canal and El-Shimi branch are the main sources of water to the area.

El-Hammami canal is one of the distributary canals obtaining its water from the Mansuriya main canal. The type of soil is sandy loam and most of the area grows vegetables. However corn and berseem are also commonly grown.

The water in El-Hammami canal follows a rotational system of 4 days "on" and 8 days "off". Due to shortage of water at the tails, the farmers have dug over 40 pumping wells for irrigation.

In both of these areas there is only very limited gravity irrigation. Mostly all water is lifted by *tambour*, *saqia* ,or diesel pumps.

III. Problem Identification:

The EWUP Mansuriya team comprising engineers, agronomists, sociologists and economists identified the following problems:

A. Low crop yields due to numerous factors which included insects, poor root development,low plant populations and a lack of improved varieties and hybrid seeds available to farmers.

B. In some cases the land was not sufficiently level for efficient irrigations.

C. Poor cross sections in both canals and *mesqas* cause water delivery problems.

D. Water flows through *mesqas* then to drains without being used by the farmers. A lack of control structures (gates) and scheduling according to farmers' demand have contributed to this problem.

E. In some cases, water shortages exist at the ends of the delivery system. This causes farmers to install their own pumps for lifting water from a tube well or a drain.

F. Small land holdings plus the complexity of crops grown limit the vaibility of various impovement program such as land leveling, irrigation scheduling, and mechanization. Furthermore, intercropping and relay cropping are common practices.

IV. Pilot Programs:

A. *Mesqa* and Canal Lining:

1. Lining of Beni Magdul canal with concrete was done in 1977. At this time the elevation of the canal was lowered thus instituting the commonly used system where farmers are required to lift their water. The lining of the canal has provided a more controlled cross section for better water conveyance and improved roads along the canal, plus requiring less space. In addition, concrete lining requires less maintenance to keep the desired cross section.

2. *Mesqa* lining trials have aided in controlling the cross sections and saving land. *Mesqa* 5 on the right handside (R.H.S) of Beni Magdul canal is an example where concrete blocks were mortered in over a plastic sheet. This method should greatly reduce any seepage losses.

3. "L"-shaped blocks were joined to form a "U" for several *mesqas* in Beni Magdul. This method provides a good cross section allowing room for roads and more crops. The Beni Magdul branch canal was lined in this way too. The reduction in cross sectional area was several meters.

4. A heavy rubber sheet was used for lining *Mesqa* 4 R.H.S. of Beni Magdul. It seemed to work well for a time. However, weeds have grown through the sheet and several cuts or tears have occurred. If animal traffic was heavy along this *mesqa* it would be doubtful that this material would hold up very long.

B. Lining and Elevation of *Mesqa* 10 L.H.S. of Beni Magdul Canal:

*Mesqa* 10 was rebuilt as an elevated channel with its water supply being drawn from Beni Magdul canal by a diesel pump.

The *mesqa* serves about 55 *feddans*. The objectives of this project were to:

1. Reduce lifting costs.
2. Replace the eight *saqias* with a simulation of gravity feed water to the farmers.
3. Provide greater discharge available for faster more efficient irrigations.
4. Provide equal and adequate amounts of water supplied at proper times to all farmers.

These objectives have been only partially achieved due to difficulties in obtaining adequate supplies of water during high demand times.

The new *mesqa* is intended to replace the *saqias* served by the old *mesqa*.. Gates correspond to the *saqia* lifting points on the old *mesqa*. These gates can discharge up to 60 lps if conditions permit and the farmer is able to manage this quantity of water.

C. <u>Pipeline Irrigation System in Hammami Area</u>:

Construction of a low pressure pipeline is intended to replace El-Hammami canal. The objectives of this project were to:

1. Reduce lifting costs
2. Save land.
3. Provide equal and adequate amounts of water to all farmers
4. Reduce conveyance losses.

The total length of the line will be 4700 meters through 50 and 60 cm asbestos cement pipes. Pump stands will supply 360 lps each through the pipeline to the 64 farm and/or *mesqa* outlets. Alfalfa valves will be the type of outlets used. Difficulties with the contractor have prevented completion of this project. It is very difficult to install this type of system under high water table conditions in Egypt.

D. Special Studies:

1. The water budget work was most thoroughly done on the Beni Magdul canal command area. The Nyrpic gates at the head of the canal have been calibrated so that the discharge into the canal is continuously being measured. This canal has been changed from an "on" and "off" period rotation to a continuous flow system of operation. The amount of water permitted to enter the canal is regulated by EWUP. We use estimates of consumptive use and farmers' demand to help make water regulation decisions. This system has reduced the amount of water going to the drains without use and reduced the amount of water used by about 10% for the area. Overall irrigation efficiency for the area is about 70%. The Beni Magdul water budget also includes water measurements on the branch canal as well as measurements of the water table and drain flow.

2. On-farm activities include water measurements and crop improvement on selected farms in both canal areas. Portable cut-throat flumes are used to measure the water applied on a farm field. Most farmers irrigate using small basins, however, long runs have been tested. Improved crops have resulted from insect control, increased plant populations and selection of improved varieties. This has resulted in above average yields.

3. In addition, on selected sites farm record data was also obtained. This information provided documentation of the farmers' economic status and provided a base for evaluation of various interventions. Approximately 15 farms on each of the canal areas were observed for several years . From this data, numerous crop enterprise cost studies were completed.

4. In the summer of 1982, a pumping test was conducted in the Beni Magdul area. This test provided information as to the amount of drainage that may be occurring from the upper water table to the deep aquifer.

V. Summary:

In summary, the work in Mansuriya consisted of problem identification with a search for solution phase. This was followed by various pilot programs which included lining of canals and *mesqas*, elevation of *Mesqa* 10, and construction of a pipeline. Special studies included water budget, on-farm water measurements, crop improvement, farm record data and pumping tests. Sociologists were of particular importance to the team since all of our work required good relationships with the farmers. Our accomplishments are a result of coordinating the abilities of engineers, sociologists, agronomists, and economists, toward a common goal.

(Draft)

# Kafr El-Sheikh Implementation Program

## SUMMARY

## I. Introduction

The EWUP site at Kafr El-Sheikh consists of 2000 *feddans* under the control of the Abu Raya cooperative on the third and final reach of Daqalt canal. Daqalt canal which serves 6400 *feddans* takes its water from Meet Yazeed canal. Abu Raya area lies in Kafr El-Sheikh District, Kafr El-Sheikh Governorate, North Delta Region of Egypt. The area was chosen for EWUP's work due to its special conditions of saline soils, rice production, and clay soils. The average holding size of 3 *feddans* was considered representative of the country as a whole.

Since 1978, an interdisciplinary team of engineers, agronomists, economists, and sociologists have carried out a research development process consisting of three phases: problem identification, solution search, and implementation. Team activities have been concentrated on-farm although data collected through a water budget study have provided insights into the delivery system.

## II. Problem Identification

Through the assistance of the Abu Raya cooperative two *mesqas* serving about 200 *feddans* each, Om Sen and Hammad *mesqas*, were selected for problem identification studies. Two farms were selected for intensive study on each *mesqa*, one at the head and the other at the tail of the *mesqa*. Relevant data were collected for several seasons and a number of problems were identified.

Volumes of water delivered by the canal system do not always match crop needs. During critical water demand periods, such as rice transplanting and cotton planting, water shortages occur. During periods of low demand, excess water delivery overtops canal banks causing crop damage. Canal cross-sections are excessively large due to erosion and borrowing of soil to make bricks.

After water is lifted from *mesqas* by water-wheels or pumps, it flows to the field through on-farm channels called *marwas*. These *marwas* are of excessively large cross-section and full of vegetation resulting in water losses of about 25% of water lifted on the average.

At the field, water application depths were found to be excessive due to unlevel fields and the traditional farmers' practices. Row crops such as cotton and sugar beets are grown on short furrows in basins requiring a complex *marwa* network.

Crop yields are sometimes low due to poor varieties, soil salinity, and micronutrient deficiency. These problems are increased by poor infrastructural support in providing fertilizers, seeds, chemicals, and equipment to the farmer. Labor shortages cause delays in field operations such as planting and harvesting and reduce the farmer's net income due to high cost.

Non-functional field drains occupy up to 15% of the field area. These drains are too shallow to drain the water table and are used primarily to drain excess surface water. In some cases water was observed to stand in field drains due to vegetation and poor drainage outlets. Water standing in field drains actually contributes to the water table. Collector and secondary drains are poorly maintained.

## III. Implementation and Work Plan Changes

Through a process of solution testing by field trials, Kafr El-Sheikh team developed an implementation program designed to increase the farmer's socio-economic wellbeing and to improve on-farm water management.

Farmers were organized to clean their *mesqas* during the winter closure period. The on-farm water conveyance system and field layout were redesigned to minimize *marwa* length. *Marwas* were constructed and shaped to reduce water losses due to seepage, leakage and dead storage.

At the field, the land was dead leveled with a tolerance of ±2 cm. Field drains were eliminated wherever possible. Borders of lengths up to 200 meters were constructed for the basin crops of rice, wheat, berseem, broad beans, flax, and barley. Long furrows with beds of width 1.1 meters were constructed for row crops such as cotton and sugar beets. Farmers were advised on how to use the new systems to save time, labor, water, and lifting costs.

Kafr El-Sheikh team assumed the task of agricultural extension by advising farmers concerning crop variety, fertilizer timing and amount, pest control and cultural practices. Zinc sulfate was introduced to correct a micronutrient deficiency and trials were conducted with urea application.

The implementation program evolved as the team learned more about the on-farm irrigation system. A *marwa* improvement program was developed in which such practices as *marwa* lining by plastic sheets and *marwa* replacement by lay-flat plastic pipe and aluminum-gated pipe were tested. Siphon tubes were tested and rejected due to uneven discharge from *saqias* and logistical problems in siphon transport from farm to homestead.

Through the on-farm work it became apparent that on-farm problems were often due to irregularities in the water delivery system. Farmers cited insecurity of water delivery as a reason for irrigating at high field soil moisture status. At other times, high

canal water levels facilitated uncontrolled gravity irrigation leading to inefficient water applications. Farmers were found to irrigate primarily during the day although water is provided day and night during the Daqalt canal on-period. Due to these factors a recent development in K.S. work has been to expand the team's emphasis from on-farm water management to complete irrigation water management which includes the delivery system.

## IV. Evaluation of Implementation

The K.S. implementation program has been evaluated in technical, economic, and social terms. Yield and plant population data has been collected. Water lifted, applied, and stored has been measured by cut-throat flumes and soil sampling techniques. Water table fluctuations have been monitored by observation wells. Soil and water salinity samples have been taken.

After each implementation season, profitability of new technologies is tested by economic enterprise cost studies. Acceptability of implementation program practices is evaluated by sociological contact records. Operational problems such as accessibility to farmers' fields and side effects of introducing new technologies were considered. A stability of new practices study is planned for the following year. The Project's degree of success in meeting its goals of improvements in on-farm water management is constantly under review. Through this review process, the key concept is irrigation water management improvements and the farmer is seen as the center of the research development effort.

## V. Conclusion

The Kafr El-Sheikh EWUP experience has shown the feasibility of an interdisciplinary effort in improving irrigation water management under actual field conditions. Problems have been identified and solutions have been proposed with due consideration to the constraints imposed by all components of the irrigation system. A package of new technologies has been applied and tested. The need exists to facilitate further interdisciplinary efforts in irrigation water management improvements through existing or new organizations as appropriate.

(DRAFT)

# EXPERIENCE WITH WATER USERS ASSOCIATIONS

## SUMMARY

1. Introduction:

   1.1. Concept that a socio-political network manages the physical component of an irrigation system.

   1.2. Effective irrigation management must involve the following:
   - Acknowledgement of a total system perspective.
   - Understanding of control capacity vs control utilization.

   1.3. Role of Water Users Association (WUA) in irrigation management.

2. Definition/Purpose of a WUA:

   2.1. Definition: a group of farmers all served by a common source of water, who join together to allocate, distribute, and manage water in the most efficient and equitable manner.

   2.2. Major purposes of a WUA
   - Mobilization of local resources
   - Resolution of conflicts
   - Administering the delivery of water, and the cleaning and maintenance of water courses.
   - Communication link between government officials and farmers.
   - Means by which farmers make decisions concerning problems of irrigation.

3. Existing Organizational Arrangements:

   3.1. Public Irrigation Schemes
   3.2. Irrigation Associations.
   3.3. Mixed Control Schemes
   3.4. Situation in Egypt.

4. Establishing WUA:

4.1. Principles for establising WUA

- Goals/objectives for establishing a WUA
- Recognition of differences between the public and private sectors.
- Principle of local participation and involvement.
- Developing an acceptable pattern of organization
- How a WUA will function in relation to the broader government policy and operation of the system.

4.2. Strategy for establishing WUA

- Introductory Period
- Planning Period
- Organization Period
- Preliminary Period
- Training Period
- Operational Period
- Continuation Period

5. Administration of WUA:

5.1. Critical issues to be addressed

- Size of the organization
- Horizontal/Vertical dimensions of the organization
- Homogeneity/Heterogeneity of the organization.
- Jurisdiction of the organization
- Procedures of the organization
- Formal/Informal aspect of the organization
- Hierarchy of associations

5.2. Structural components of WUA

- General body of the association: all qualified members of the association (i.e. cultivating landowners, non-cultivating landowners, tenants)
- Managing body of the association: the executive body of the association which performs the tasks approved by the general body.

- Judicial sector of the association: a special body of association members, selected by the general body, who settle disputes.

5.3. Procedural component of WUA

- Task assignments
- Maintenance procedures
- Communication network
- Decision-Making procedures
- Coordination processes
- Control procedures
- Adaptation procedures
- Conflict processes.

6. Conclusion

(DRAFT)

# A PROPOSED IRRIGATION ADVISORY SERVICE

## SUMMARY

1. Introduction

   1.1 Assumption: effective management of the irrigation system demands that efforts be made to improve all aspects of the system; including the on-farm component.

   1.2 On-farm development is frequently left to the farmers' initiative alone. However, in order for such development to occur in the most effective manner, some technical help is generally needed.

   1.3 The establishment and effective operation of an on-farm advisory service can provide the mechanism whereby the needed technical help may be diffused to the farmers.

2. Purpose of an Irrigation Advisory Service (IAS)

   2.1 Irrigation assistance at the farm level is a relatively new approach (with one or two decades of existence) and few countries have attempted it.

   2.2 Main areas where irrigation assistance at the farm level is needed.

      2.2.1 Advice to farmers on how to improve their irrigation practices and to establish irrigated crops;

      2.2.2 Assistance to farmers in improving the farm layout;

      2.2.3 Encouragement for farmers to organize themselves into groups for the operation and maintenance of the tertiary systems and their improvement when needed.

   2.3 Justification for establishing IAS.

3. Establishment of an Irrigation Advisory Service

   3.1 Concept of Institution Building: the planning, structuring,

and guidance of new or reconstituted organizations which (1) embody changes in values, functions, physical and/or social technologies; (2) establish, foster, and protect new normative relationships and action patterns; and (3) obtain support and complementarity in the environment.

3.2 Organizational Components of an IAS

3.2.1 Leadership: The group of persons who are actively engaged in the formulation of the doctrine and program of the organization and who directs its operations and relationships with the environment.

- Technically Competent
- Politically Competent
- Commitment

3.2.2 Doctrine: The specification of values, objectives, and operational methods underlying social action.

- The Research Development Process.
- Interdisciplinary Work.

3.2.3 Program: Those actions which are related to the performance of functions and service constituting the output of the organization.

- Assumptions
- Characteristics of the Program
- Principles of Program Planning
- Program Execution

3.2.4 Resources: The financial, physical, human, technological and informational inputs of the organization.

- Legal, political authority
- Personnel
- Funds
- Equipment
- Facilities
- Information
- Staff Development

3.2.5 Internal Structure: The structure and processes established for the operation of the organization and for its maintenance

- Formal/Informal Patterns of Authority
- Division of Labor
- Channels of Communication

3.3 External Linkages Affecting the IAS

3.3.1 Enabling Linkages: Organizations and social groups which control the allocation of authority and resources needed by the organization to function.

3.3.2 Functional Linkages: Those organizations performing functions and services which are complementary in a production sense, which supply the inputs and which use the outputs of the organization.

3.3.3 Normative Linkages: Organizations which incorporate norms and values (positive + negative) which are relevant to the doctrine and program of the organization.

3.3.4 Diffuse Linkages: Elements in the society which cannot be clearly identified by membership in formal organizations.

4. Conclusion

EWUP/D R A F T
21 May, 1983

# IRRIGATION PRACTICES OF EWUP STUDY CASES

## ABYUHA AND ABU RAYA SITES

## FOR 1979 - 1980, 1980 - 1981, AND 1981 - 1982

### PURPOSE

The purpose of this report is to document the actual irrigation practices of the farmers in two Egypt Water Use and Management Project study areas, Abyuha in El Minya Governorate and Abu Raya in Kafr el Sheikh Governorate, and to examine how there aggregate use places demands on the irrigation delivery system in the respective areas. The actual farmer practices compared to the published expected practices, determined from consumptive use analysis, are presented for each crop. An evaluation of the management of the irrigation delivery system is also presented through the comparison of the amount of water discharged from the main canals into the irrigation delivery system in the two demand areas with the farmer's aggregate use in the area.

### METHODOLOGY

Consumptive use values for the major crops produced in Egypt, published in Technical Report No. 17, UNDP-EGY, 1981, provided an estimate of the continuous needs of each crop following the optimal planting date, determined from experimental conditions, and continuing until harvest. Data on the farmer practices were abstracted from the EWUP Farm Records for the 1979 - 1980, 1980 - 1981, and 1981 - 1982 record years. The farm record year does not coincide with the "agricultural year" since the record year only defines a specific period in time. The study case data were divided into 15 day periods with the winter closure period

eliminated from the analysis. The irrigations include pre-irrigation of cotton, wheat, and maize, and the post-irrigations of cotton when they occurred.

## SUMMARY AND RECOMMENDATIONS

The efficient planning of irrigation water deliveries depends on knowing what demands the farmers are placing on the irrigation water. This in turn depends on what crops the farmers are growing, the area devoted to each crop, and the number and timing of irrigations they apply. The latter is largely dependent on the soil water depleted as determined by consumptive use.

The purpose of this report is to document the actual irrigation practices of the farmers in two Egypt Water Use and Management Project study areas, Abyuha in El Minya Governorate and Abu Raya in Kafr el Sheikh Governorate, and to examine how there aggregate use places demands on the irrigation delivery system in the respective areas. Data on the farmer practices were abstracted from the EWUP Farm Records for the 1979 - 1980, 1980 - 1981, and 1981 - 1982 record years. The actual farmer practices compared to the published expected practices, determined from consumptive use analysis, are presented for each crop. An evaluation of the management of the irrigation delivery system is also presented through the comparison of the amount of water discharged from the main canals into the irrigation delivery system in the two demand areas with the farmer's aggregate use in the area.

When comparing the actual planting and harvest dates with the expected planting and harvest dates for the two areas, Abyuha in El Minya Governorate and Abu Raya in Kafr el Sheikh Governorate, it was obvious that the farmers plant their crops over an extented period of time. This implies that each field was grown under a slightly different microclimate and had slightly different consumptive use

demands than those expected in the consumptive use tables. The analysis indicated, taking into consideration one or two exceptions, that crops were planted two to three weeks after the expected planting dates and harvested about two weeks later than the expected harvest dates.

Comparing the actual number of irrigations per crop with the expected number indicated that, with the exception of maize, the farmers generally apply close to the number of irrigations or in some cases fewer irrigations. Farmers in El Minya tended to apply one or two irrigations more per crop than the farmers in Kafr el Sheikh. This is assumed to be partly due to the warmer climate in El Minya resulting in increased evapotranspiration and consumptive use and the potential for rain, even though erratic in both time and space, in Kafr el Sheikh.

The period from last irrigation to harvest tended to be longer in Kafr el Sheikh than El Minya. The period was usually one or two months in length with the longest periods for a cotton crop where a wheat crop was to follow. The shortest periods were for rice and maize which were two weeks or less in length.

The time between irrigations of sequential crops, referred to by EWUP personnel as the "irrigation gap", is a period of low demand on the irrigation delivery system. The longest irrigation gaps occurred in the Kafr el Sheikh study area between the cotton and the wheat crops, 118 days, and between the wheat and rice crops, 83 days. In El Minya the irrigation gaps tended to be shorter averaging 85 days for the period between the cotton and wheat crops and 07 days for the period between the broadbean and maize crops.

A limited number of pre and post irrigations were found among the study cases. Since both the pre and post irrigations occurred during periods of extensive irrigation gaps, it was concluded that these irrigations have little

impact on the management of the irrigation system.

The actual demands on the irrigation delivery system in the study cases indicated that the high demand periods fall immediately preceding and following the winter closure period and the periods during the summer months. Other periods of high demand were in November and March in El Minya and in November, March and April in Kafr el Sheikh.

Comparing the quantity of water discharged into the delivery system with the actual farmer demands provides useful feedback for future planning. This analysis indicated that in the Abyuha area the periods with high (low) discharges into the delivery system did not always correspond to periods of high (low) demand on the system. For the Om Sen area in Kafr el Sheikh, the amount of water discharged into the delivery system during the November through April periods of 1981 - 1982 relative to the demand on the system should be noted for future planning. The high discharges encountered during these 1981 - 1982 periods do not necessarily correspond to periods of high demand (consumptive use) such as those found during the summer periods.

In general the discharge data and the estimated demand data reflect the biases from the expected planting/harvest dates and the actual farmer planting/harvest dates. With the expected dates being consistently earlier than the actual dates, the use of expected dates for planning purposes would not lead to an optimal delivery allocation. It is also obvious that delivery of excess water during irrigation gap periods or during periods of low demand will not offset minimal delivery quantities when the demand is high.

Several recommendations evolved from the analysis of actual farmer practices and expected practices.

1. Consideration must be given to the actual planting and harvest dates of the various crops produced in

the area when planning discharges into the delivery system. The analysis indicated a two to three week difference in planting dates which is significant when determining periods of high consumptive use.

2. Although excess water is available for irrigation during some periods during the year, farmers tend to irrigate no more than the recommended number of times. However, conditions of high water in the delivery system, such as those encountered in the November through April Om Sen data, are not condusive to reducing the water table level and should be rectified in future planning.

3. The information on actual farmer practices abstracted from the EWUP farm records is useful in providing feedback for the delivery system planning mechanism. This feedback should continue for determining the delivery systems needs in the future.

# CROP MANAGEMENT STUDIES BY EWUP

## SUMMARY

In an attempt to improve crop production, EWUP agronomy team conducted crop management studies in the three Project sites; Mansuriya, Kafr El-Sheikh, and El-Minya.. The studies were conducted during the 1978/79, 1979/80, 1980/81 and 1981/82 agricultural years.

Crop management studies were conducted in two stages, field trial studies and agronomic practices application.

### I. Field Trial Studies

Field trial studies were conducted in the three Project sites during the 1978/79, 1979/80 and 1980/81 agricultural years.

Field trial studies included the following:

A. Density of plantings.
B. Application of fertilizers.
C. Use of insecticides.
D. Use of new varieties.
E. Improved water management.

The following conclusions are drawn:

A. The plant densities were considerably below those recommended by the Ministry of Agriculture for different crops (corn, cotton, broad beans, etc.). Consequently, the yield significantly increased by simply growing more plants, assuming all other factors (fertilization, weed and pest control, good variety of seeds) were constant at the recommended rates.

B. The evaluation of the effect of foliar fertilizer application "Bayfolan" on cotton and corn showed that for cotton and maize the recommended rate of "Bayfolan" is 0.8 liter/400 liters water per *feddan*.

For cotton: Twice spraying of "Bayfolan" (the first at flowering stage and the second at the start of boll-formation), had significantly increased the following:

The cotton plant height (13.5 cm), number of bolls (6.5 bolls per plant) and cotton seed yield (0.65 ton/ha) relative to non-treated sites.

For Corn: The spraying of "Bayfolan" (in time) one month after planting, significantly increased the yield of corn grain by 1.3 *ardebs* more than the control.

This means that the small amount of liquid fertilizer containing most of the macro-microelements, applied in the form of foliar application had significantly increased the yield of different crops such as cotton and corn in this study.

C. Concerning the effect of pest control on crop production, when aphids were controlled by insecticide spraying, the yield increases were 40% and 18% for corn and wheat respectively.

- Spraying of tomato plants against the white fly infestation by Tamaron 66% 1 liter/*feddan* every fortnight for a period of four months, one month in the nursery and three months in the field, increased the yield by two times or even more than that of the non-treated areas.

- The hand-picking of cotton leafworm egg masses was an efficient control measure in this study.

D. Regarding the effect of new varieties on the yield, the following results were obtained.

1. Corn

Three maize varieties were used in Mansuriya site, "Balady", Early American, and Pioneer 514. The results showed that both the Pioneer 514 and the Early American varieties held a yield advantage of 18 and 19% respectively over the "Balady" variety. The returns above cost for Pioneer 514 and Early American varieties were greater by 22 and 15% respectively than the "Balady" variety.

2. Wheat

In Kafr El-Sheikh area, two wheat varieties were used, Giza 155 and Sakha 8. The results showed that Giza 155 (local variety) is low-yielding but with the new promising wheat variety (Sakha 8), yield could be increased by 0.5 ton/*feddan* (48-50% increase).

E. Concerning the effect of improved water management on the yield of different crops, EWUP Kafr El-Sheikh team has conducted field trials to test four different treatments of irrigation and agronomic practices on four strips of cotton.

The results indicate that the treatments, combined EWUP water management and agronomic practices (land leveling, dead level, long furrow irrigation, irrigation scheduling, use of recommended pesticides, fertilizers and micronutrients), have the highest mean yield of cotton.

## II. Agronomy Practices Application

Crop management practices were conducted in the Project sites during the 1981/82 agricultural year.

The agronomic practices included the following:

1. Use of recommended rates and time of fertilizer application.
2. Use of recommended varieties.

From the results of the studies conducted under field conditions, the following conclusions are drawn:

A. When the recommended agronomic practices (fertilizer rates, seedling rates, weed control) were strictly followed by the farmers, higher yields were obtained.

   Under the objective of EWUP to improve the crop production on the Project sites, the agronomy team used a new procedure for applying nitrogen fertilizer in Kafr El-Sheikh area. The results indicate that;

   1. The preplanting application of urea to cotton slightly increases the yield in comparison to the regular method of urea application.

   2. For rice, the application of urea before puddling and transplanting in the permanent land had significantly increased the yield more than after the transplanting treatment (regular method).

B. The farmers that followed the varieties recommended by the Ministry of Agriculture obtrained the following results:

- During the 1981/82 agricultural year the farmers of the Abu Raya site in Kafr El-Sheikh area used wheat variety Sakha 8 which is recommended for saline soil.

- The use of the wheat variety Sakha 8 had significantly increased the grain and straw yield.

- In 1982 summer season, the agronomy team introduced a new corn variety Giza 2 at Mansuriya in an attempt to increase the corn production.

  The results showed that Giza 2 gave more production and significantly higher yield than the other commonly used varieties "Balady".

  Nowadays, the Sakha 8 and Giza 2 varieties are known to be the best for wheat and corn, respectively.

In general, it can be concluded that higher crop production could be obtained by the use of higher yielding varieties and hybrids, recommended fertilizer rates, weed and pest control, and other recommended practices.

Also, it was observed that when the recommended agronomic practices were strictly followed by the farmers high yields were obtained.

(DRAFT)

# STATUS OF ZINC IN THE SOILS OF PROJECT SITES

## SUMMARY

In order to assess the zinc status in the soils of the three Project sites, El-Mansuriya, Kafr El-Sheikh and El-Minya, EWUP Agronomy Team conducted a series of studies during the agricultural years 1978/79, 1979/80 and 1980/81.

The studies included the soil fertility survey and on-farm field tests with various crops.

The soil fertility survey was conducted by collecting surface soil samples (0-20). 5-15% of the farms in each area were randomly selected. The soil samples were analyzed for zinc by using the $NH_4HCO_3$-DTPA method.

The results of this analysis are numerous and are available in EWUP Technical Report No. 10. In this report, the zinc data required for the present study only are summarized.

From the previous studies it was concluded that many of the soils in the Project areas seemed to be low in available zinc, in which case crop response to added zinc would be quite expected.

In an attempt to improve crop production, field trials with zinc application were conducted on the Project sites. The following conclusions were drawn from the results obtained during the winter seasons 1978/79, 1979/80 and 1980/81 on the wheat, flax and broad bean crops and for the summer seasons of 1979 and 1980 on the cotton, rice and corn crops:

For Wheat:

Zinc was applied as foliar spray in different concentrations and at different stages of plant growth up to the tillering stage of wheat plants. The results indicate that:

- The wheat sites in Minya responded to zinc spraying more than those at Kafr El-Sheikh and El-Mansuriya sites, may be due to the too low zinc availability in the soil (mean zinc value of 0.6 ppm). Thus, with zinc spraying, wheat plants highly responded to zinc uptake and consequently yield was increased.

- Spraying once with 0.4% $ZnSO_4$ at the rate of 400 liters water/fed. at the tillering stage is very effective and significantly increased the yield.

- There is no benefit from zinc spraying at the shooting stage.

- Spraying with 0.4% $ZnSO_4$ at two stages of growth gave approximately the same results of one spraying at the tillering stage.

- The straw yield was not significantly increased by zinc spraying, nevertheless, one spraying of 0.4% $ZnSO_4$ at the tillering stage was superior in this respect.

For Broad Beans:

Two pilot areas and one site using farmers' practices were selected at Abyuha to investigate the effect of zinc spraying on the grain and straw yields of broad beans. The results indicate that the spraying of 0.4% $ZnSO_4$ at the rate of 400 liter/fed. one month after planting showed a significant increase in the grain and straw yields by 53% and 16 % respectively over the control.

For Flax:

Eight fields were selected at Abu Raya where zinc sulphate at the rate of 10kg/fed. was added to one-half of each field. The results showed that zinc application significantly increased the flax seed yield. Since

flax is a dual-purpose crop, it would have been ideal if the production of flax straw increased but zinc had no effect on this component. However, a 23% increase in seed yield even though there was no change in straw yield warrants the use of zinc for flax production.

For Rice:

Field trials were conducted at Abu Raya site in the nursery and main field. Zinc sulphate was applied to the nursery at the rate of 20*kgs/fed. of nursery and 10kg $ZnSO_4$ /fed. for the main field two weeks after transplanting (tillering stage). The results indicate that:

- Grain yield significantly increased by the addition of zinc sulphate over that of the control treatment.
- Application of zinc sulphate to the nursery treatment was superior relative to the application after transplanting in the main field.
- The application of zinc sulphate at the rate of 20 kg/fed. to the nursery is the cheapest and most effective method of application.

For Cotton:

In Summer, 1980, field trials were conducted on Cotton at Abyuha, to study the effect of zinc spraying on the fiber cotton yield. The results indicated that the spraying of cotton plants by 0.4% $ZnSO_4$ at the rate of 400 liters/fed. at the flowering stage had significantly increased the yield by 41% over the control.

For Corn:

Field trials were conducted on corn during the 1979 growing season at Abyuha, to investigate the effect of application time of $ZnSO_4$ on the corn yield. The results indicated that:

- The one-time spraying of 0.4% zinc sulphate, one month after

* One feddan of nursery usually supplies enough transplants for 6 to 8 feddans of rice.

planting, had significantly increased the yield over the control.

The spraying of 0.4% $ZnSO_4$ twice decreased the yield.

From the above-mentioned presentation and discussion of the obtained results, the framers should be advised on the need of a zinc fertilization program for the soils of Project sites, taking into consideration the amount and time of adding zinc depending on the type of soil and plant characteristics.

# FARMING SYSTEM ECONOMIC ANALYSIS OF EWUP STUDY CASES

## PURPOSE

The Egyptian Water Use and Management Project (EWUP) was initiated in 1977 with the principal goal of providing significant social and economic progress for the Egyptian farmer. The role of the EWUP economist is to (1) provide a unique discipline viewpoint for the interdisciplinary EWUP team, (2) to conduct discipline specific analysis necessary to measure the economic progress of the Egyptian farmer touched by interventions undertaken by the project, and (3) provide other associated economic analysis. The purpose of this report is to present an over time comparative analysis of each project site using base measures (indicators). The comparative analysis for each site includes the set of farms for which continuous records are available, the set of all record keeper farms (each year), and those farms that are subject to a major EWUP intervention package.

## METHODOLOGY

A most important tool developed and used by the economists in the Project is the EWUP Farm Recordbook. The recordbook was developed to collect information from a selected group of farmers at each of the project sites to measure the economic change of the farmer and provide a source for basic technical and economic information. The farm recordbook approach provides for timely collection of data (typically every two weeks an EWUP field staff economist will visit each of his record keeper farmers and update their record). This multiple contact approach provides the opportunity to build a trusting relationship between the farmer and the

field economist. This trusting relationship helps ensure accurate and complete data collection. The recordbook methodology is also desirable because it provides a whole farm or farm system orientation.

The comparative analysis (over time) is based upon several measures of input use, costs, and measues of productivity. Included are measures for land, crop distribution, crop intensity, crop productivity, crop expenses, family members, working assets, livestock number, livestock index, livestock value, livestock productivity, net farm income, crop ratios, livestock ratios, asset and income ratios, and net returns per thousand cubic meters of water.

## SUMMARY AND CONCLUSIONS

The purpose of this report is to summarize the EWUP farm records for the period 1978 - 1979 through 1981 - 1982. Data are presented for each of the three sites for (1) the set of farms which have provided data continuously through this time period, (2) the set of all record keeper farms available each year, and (3) the farms that are directly associated with a major EWUP intervention. Information on farm size and tenure, cropping patterns, crop intensity, crop productivity and crop expenses are presented. Also shown are data on the number of family members, working assets, livestock numbers by species, a livestock index, livestock value, livestock productivity, and net farm income. Ratios are developed for crop productivity, livestock productivity, working assets, net farm income, and net returns per thousand cubic meters of water.

The report has focused upon a descriptive analysis; thus the role of the factors that have caused the changes during the record keeping period has not been emphasized. Neither has there been a focus upon comparing the farms of the different EWUP sites.

Some consistent trends in the analysis are: (1) the importance of share rental agreements for land is increasing, (2) the cropping patterns are not static (in the Mansuriya area the production of garden crops is high and increasing, sugarbeets have entered the crop rotation of the Abu Raya farmers since the opening of the sugarbeet factory in 1980 - 1981, and the soybean area is increasing at Abyuha), (3) typically crop productivity and livestock productivity have increased over time but the source of this increase is most likely a combination of price increases, enterprise changes, and more intensive input use, (4) working assets, livestock value and net farm income have typically increased but a majority of this rise may because of price inflation, (5) in most cases the relative importance of livestock has increased, and (6) net returns per thousand cubic meters of water typically has decreased and in several situations is negative.

It must be noted, however, that water returns are computed as a residual factor payment and negative returns may be caused by (1) "over paying" other resource factors, or (2) low farm incomes. The negative returns to water should not be interpreted as meaning that water has a negative value in the production process.

# WATER BUDGETS FOR IRRIGATED REGIONS IN EGYPT

## SUMMARY

### Introduction

A water budget is an account of all water that enters, exits, and is stored in a region with defined boundaries during a specific period of time. Water budgets were compiled for three small irrigated regions in Egypt: Abyuha in Middle Egypt, Beni Magdul near Cairo, and Om-Sen in the North Delta. The report summarized here presents the rationale, procedures, and results of these studies and draws conclusions of interest to irrigation water management in Egypt.

### Site Descriptions

The three regions were selected because they seemed representative of irrigated agriculture in Egypt and because their features allowed well defined hydrologic boundaries. The Abyuha region encompasses a total hydrologic area of approximately 1200 *feddans* (504 ha). The total cropped area is about 1100 *feddans* (462 ha). The Beni Magdul region is comprised of approximately 842 *feddans* (354 ha) of which about 810 *feddans* (340 ha) are cultivated. The Om-Sen region is composed of about 260 *feddans* (109 ha) of which about 235 *feddans* (99 ha) are cultivated. The types of crops cultivated varied considerably from region to region and from season to season. Seasonal crop surveys for each region are presented in the full report.

The aquifers in each of the regions have the same general description: a clay-silt layer supporting a phreatic aquifer and forming a semi-confining cap over an underlying sand aquifer. The hydraulic characteristics of the aquifers, however, vary considerably from region to region. The thickness of the clay-silt layer is about 10 m in Abyuha, about 14 m in Beni Magdul, and about 35 m in Om-Sen. Measured values of horizontal hydraulic conductivity in the clay-silt layer were an

average of 1.5 m/day in Abyuha, a range of 0.018 to 0.60 m/day in Beni Magdul, and an average of 0.06 m/day in Om-Sen. Monthly average depth to water table ranged from 1.20 to 1.91 m at Abyuha, 0.66 to 0.90 m at Beni Magdul, and 0.20 to 0.70 m at Om-Sen. The high water table at Om-Sen is attributed to extensive rice culture and poor vertical drainage.

The canals delivering water to the Abyuha and Om-Sen regions were on a rotation water delivery system. In Beni Magdul the continuous flow system was utilized.

## Water Budget Model

When appropriate vertical and horizontal boundaries have been specified, an irrigated region may be defined as a hydrologic control volume for purpose of water budget studies. A control volume is a volume in space having specified boundaries across which mass may flow. In an irrigated region, the surrounding drains and canals locate the vertical boundaries. The horizontal boundaries are a subsurface semi-permeable layer and the top of the crop canopy. Water flowing across the boundaries of the region and the resulting change in the volume stored within the region are subjects of a water budget study.

The basic principle for any water budget study is the general equation of continuity for a fluid. For hydrologic studies, a simplified form of the equation for a fixed control volume and a specific period of time may be used:

$$I_T - O_T = \Delta S_T \qquad (1)$$

Where

$I_T$ = total inflow volume of water into the control volume during time period T, ($m^3$)

$O_T$ = total outflow volume of water from the control volume during time period T, ($m^3$)

$\Delta S_T$ = total change in volume of water stored within the control volume during time period T, ($m^3$)

The continuity equation was further expanded to define the individual components which are listed as follows:

$I_A$ = total volume of surface inflow ($m^3$)

$I_B$ = total volume of subsurface inflow ($m^3$)

$I_C$ = total volume of precipitation ($m^3$)

$O_{A1}$ = total volume of surface outflow as drainage ($m^3$)

$O_{A2}$ = total volume of surface outflow to irrigate adjacent areas ($m^3$)

$O_{B1}$ = total volume of vertical subsurface outflow ($m^3$)

$O_{B2}$ = total volume of horizontal subsurface outflow ($m^3$)

$O_C$ = total volume of crop consumptive use ($m^3$)

$O_D$ = total volume of evaporation from free water surfaces ($m^3$)

$\Delta S_A$ = total storage change in surface water volume ($m^3$)

$\Delta S_B$ = total storage change in subsurface water volume ($m^3$)

Each of these components was identified and described for each of the three regions. Water budgets for each region for selected seasons were compiled by accounting for each of these components.

## Data Collection and Analysis

Detailed descriptions of how data were collected and analyzed to determine the values of the water budget components are given in companion reports for the Abyuha, Beni Magdul, and Om-Sen sites. For summary descriptions of the methods of determination the reader is referred to the full report.

## Results

Vertical subsurface outflow, $O_{B1}$, in the form of deep percolation was a significant component of the water budget in Abyuha and in Beni Magdul. It made up 16% to 36% of the total inflow ($I_A+I_B+I_C$) in Abyuha. In Beni Magdul it was 37% to 62% of the total inflow ($I_A+I_B+I_C$). Deep percolation in Om-Sen was negligible due to the thick, relatively impermeable clay layer and the very small hydraulic gradient. Salts are transported out of the unconfined aquifer in the drainage water; hence, it would be expected that for a similar quality of irrigation water the salinity of the groundwater would be significantly greater in Om-Sen where vertical drainage is small than in Abyuha or Beni Magdul. Project data on salinity in observation wells suggests that this is, in fact, the case.

In Beni Magdul where canal inflow is closely regulated according to crop need, the pattern of inflow closely follows that of consumptive use. The patterns are not as clearly matched in Abyuha and Om-Sen. Total water diverted during winter seasons ranged from 4419 $m^3$/*feddan* to 4440 $m^3$/*feddan* in Abyuha and 2685 $m^3$/*feddan* to 3174 $m^3$/*feddan* in Beni Magdul. Summer season values ranged from 7175 $m^3$/*feddan* to 10419 $m^3$/feddan in Abyuha, from 3601 $m^3$/*feddan* to 4217 $m^3$/*feddan* in Beni Magdul, and were 6810 $m^3$/*feddan* in Om-Sen. Average winter season crop consumptive use was estimated as 1527 $m^3$/*feddan* in Abyuha and 1754 $m^3$/*feddan* in Beni Magdul. Average summer consumptive use was estimated as 3478 $m^3$/*feddan* in Abyuha, 2860 $m^3$/*feddan* in Beni Magdul and 2298 $m^3$/*feddan* in Om-Sen.

Seasonal irrigation efficiency ranged from 32 to 49% in Abyuha, from 50 to 76% in Beni Magdul, and was 34% in Om-Sen. Engineered control of canal deliveries to Beni Magdul is believed to be the reason for the higher efficiency there. Inadequate control of deliveries during periods of low consumptive use resulted in excess water released to drains in Abyuha and Om-Sen.

Additional details of the water budgets are summarized in tables and figures in the full report.

## Conclusions

(1) The water table was consistently high for each site studied. Considerable seasonal fluctuation was noted at each site with the indication being that the water table was highest during periods of highest inflow and lowest following the period of canal closure. Changes in groundwater storage associated with this fluctuation were very small.

(2) Vertical drainage was a significant component of the water budget at Abyuha and Beni Magdul. However, it was very small in Om Sen In this region it is expected that the salinity of the phreatic aquifer will increase in severity.

(3) Horizontal movement of groundwater is negligible at all three sites due to very small horizontal gradients in head and low horizontal permeabilities.

(4) In Beni Magdul careful regulation of canal headgates to control inflow resulted in a relatively high value of regional irrigation efficiency and only a small amount of water released as surface drainage. However, in Abyuha and Om Sen inadequate control resulted in high losses of surface drainage and low irrigation efficiencies.

(Draft)

# REVIEW OF SOIL FERTILITY SURVEYS *

## (Summary)

Egypt Water Use and Management Project is designed to assist in improving the irrigation and farm management practices of small farmers. A soil fertility survey was conducted to determine the soil fertility status of small farms in project sites as specified in the contract.

The soil fertility survey was conducted in the project sites located in Kafr el-Sheikh, Giza, and El-Minya governorates. The sites were Abu Raya, El Mansuriya and Abyuha, respectively. Two locations in El Mansuriya, namely Beni Magdul and El-Hammami were used. The objectives of the survey were:

1) to obtain information on the available nutrient levels and their variability in the soils of EWUP sites.
2) to determine the feasibility of providing soil testing services for Egyptian farmers.

Ten to fifteen percent of the farms in each area were selected at random. Two soil samples per farm were obtained. All soil samples were analyzed for pH, EC, and available P. Potassium was determined in Beni Magdul and El-Hammami sites representing a moderately heavy soil and a sandy soil, respectively. Nitrates, Zn, Fe, Cu and Mn were determined in a varying number of samples equivalent to 2-10% of farms in a given area.

A logarithmic transformation made the distribution of above measurements closer to a normal one except for pH which had a near normal distribution to begin with.

Analysis of variance was done on the pH values and on the transformed data. The components of variance were determined. Sampling intensity was calculated at different levels of sampling error for the geometric mean of soil parameters.

The salinity levels have been interpreted for moderately sensitive and fertility for sensitive crops, respectively.

The average EC values showed that about 37, 24 and 35% of Abu Raya, Beni Magdul and El-Hammami soils were moderately to highly saline, while only 6% of Abyuha soils were saline. This finding once again reveals the importance of monitoring soil salinity for evaluation of on-farm water management practices of small farmers.

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Nitrate distribution in soils of Abu Raya farms to be planted to cotton and El-Hammami vegetable farms showed enough variation to make an evaluation of soil test for nitrates valuable. Nitrate was not determined in Abyuha soils. In Beni Magdul farms and AbuRaya farms to be planted to rice a large proportion of soils tested low in residual $NO_3$-N.

Considering average P fertility of the soil profile to a depth of 60 cm, response to phosphorus fertilizers will probably be small in El-Hammami and Beni Magdul, and probably moderate to large in other areas. However, 70, 43, and 84% of surface samples (0-20 cm) may be classified as low in P availability in Kafr el-Sheikh, El-Mansuriya and El-Minya sites, respectively. If root depth is limited to surface soils then response to P is expected in these soils. Field experiments are required for a better calibration of phosphorus soil test.

Zinc levels are low in a large proportion of soils in Kafr el-Sheikh, El-Hammami, and El-Minya areas and response to zinc fertilization is highly probable for sensitive crops growing in low testing soils. Most Beni Magdul soils were well-supplied with Zn but 18% of samples tested low to marginal in Zn availability.

Potassium levels were high in soils of all pilot areas except in El-Hammami soils (sandy soils) where only 3% of soils tested medium in available K. If potassium fertilizers are used, then they should be used in low to medium testing sandy soils, especially for crops that require high K levels such as potatoes and fruit trees.

Iron availability was marginal to deficient in 8% and 54% of Beni Magdul and El-Hammami soil samples, respectively. Abu Raya and Abyuha soils were well-supplied with Fe. Manganese and copper availability indices were found to be adequate for crop production.

The results indicated that soil testing for fertility evaluation could be done for each hôd located in Abu Raya and Abyuha sites. This was due to the lack of a significant difference between soil fertility, EC and pH values of farms within each hôd. Most farms within each hôd also follow a uniform cropping pattern at least for summer crops.

In Beni Magdul and El-Hammami vegetable growing areas soil testing based on composite sampling of a number of farms should not be followed due to the diversity of cropping patterns, high cost of vegetable production and high risks involved. If samples from each farm are

obtained, the cost of soil testing per feddan will be high due to small size of farms. A suggested strategy is to obtain samples from a number of farms in each village and to make farmers aware of what nutrients were found deficient in their area. These nutrients may then be provided for farmers who desire to purchase them. It is imperative that farmers be shown the proper use of micronutrients, such as zinc, with which they have very little experience.

It is suggested that for determination of fertilizer requirement of each crop, 30 soil sampling units (one shovelful of soil = sampling unit) to a depth of 60 cm be obtained from 30 different farms per hôd in Kafr el-Sheikh and El-Minya governorates. This sampling intensity will result in a 95% confidence interval of geometric mean of about ±14% for P, ±23% for Zn in both areas and ±27% for $NO_3$-N in Kafr el-Sheikh. Nitrate test was not run on El-Minya soils.

It should be emphasized that field fertilizer experiments should be carried out for a better calibration of soil test results.

(Draft)

# REVIEW OF SOIL CHARACTERISTICS STUDIES *

(Summary)

A soil characterization survey of the three EWUP sites was carried out. Maps were drawn to show sampling locations, salinity and sodicity. Tables of chemical and physical analyses as well as a morphological description of some representative soil profiles were also included. The soil moisture characteristics and soil water relations are discussed in detail in a separate issue entitled " Irrigation Management of Soils at EWUP Sites".

The data showed that, according to "The Soil Taxonomy", El-Hammami soils are in the order Entisols while Beni Magdul and Abu Raya soils are mostly in the Vertisols order with some Entisols included. The Abyuha soils are entirely in the order Vertisols. Details about suborders, great groups, subgroups, series and phases are included in the Technical Reports.

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*- EWUP Technical Report #2 "Preliminary Soil Survey Report for the Beni Magdul and El-Hammami Areas",
- EWUP Technical Report #33 "Soil Survey Report for Abyuha Area, Minya Governorate",
- EWUP Technical Report #34 "Soil Survey Report for Abu Raya Area, Kafr El-Sheikh Governorate".

(Draft)

# IRRIGATION MANAGEMENT OF SOILS

## at

## EWUP SITES

(Summary)

Most of the alluvial soils of the Nile Valley and Delta and thus most of the "Old" agricultural lands of Egypt are classified as Vertisols. The Vertisols is probably the most difficult of the ten soil orders to be physically managed. The basic problem with managing Vertisols is shrinking and swelling caused by water moving into and out of the interlayers of the clay plates during wetting and drying cycles that follow irrigation of these soils. These shrinking and swelling properties affect almost all aspects of water management. The physical movement impedes compaction and encourages seepage resulting in excessive conveyance losses. It also rapidly reduces infiltration rates and then restricts the internal water movements to the upper 30 cm of the soil. Root penetration is also restricted to the upper 30-40 cm, so the operationally available water is limited to 5-7 cm resulting in water table build up and this needs subsurface drainage.

In sandy areas, stratification which formed either through soil formation or through reclamation of sandy soils adding finer soil fractions or farmyard manure, resulted in different water retentivity along the soil profile. This may hinder the infiltration rate and decrease the water retaining capacity of the soil profile. Under these conditions, water management (i.e., irrigation scheduling, amount, duration and time of water application) must be taken into consideration because of the changing in the infiltration rate during irrigation.

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* S.P. 60: Soil Moisture Characteristics of Some Irrigated Soils in Egypt, DWP #113: Problems of Irrigating Vertisols in Egypt, and DWP #114. Water Management of Egyptian Vertisols.

In general, data obtained from the different types of soils show that identifying soil moisture characteristics and soil water relations for the soil profile and especially for the root zone area is very important in water management, in addition to the other soils and water properties..

AT/mm

(DRAFT)

# ON THE WATER QUALITY OF IRRIGATION CANALS, DRAINS AND GROUNDWATER IN ABU RAYA AREA KAFR EL-SHEIKH

## SUMMARY

Monthly water samples were collected from irrigation canals, drains and observation wells in Abu Raya area, Kafr El-Sheikh Governorate during the period from March 1982 to January 1983 and on February during mid-closure. The water was analyzed for its soluble salt content and different anions and cations, and the values of SAR, $PH_c$ and adjusted SAR were calculated in order to rate the suitability of this water for irrigation. The analysis of water taken from irrigation canals indicates that the soluble salt of the water is low throughout the months of the year. The adjusted SAR values were below the Guideline value for no sodicity problem ($<6$). In most cases the composition of the water at the head and tail of the canal did not vary greatly. Generally the water of the canals could be considered of good quality for irrigation purposes, except during the winter closure where the water in some locations through the canal section was changed and became of poor quality with respect to its adjusted SAR values.

Analysis of drainage water indicates that the composition of the water of each drain varied from time to time during the year and also with the location on the drain section. The electrical conductivity of the drainage water was moderate throughout the year and according to the "Guidelines" it would cause increasing salinity problems (EC = 0.75 - 3.0 mmhos/cm) when used in irrigation. However, during the winter closure, the salt content of the water reached relatively higher values. The values of adjusted SAR varied widely throughout the months of the year. It was found that during some months, the values were quite low and the water was expected to cause no sodicity problems whereas in

other months, the values were relatively or even excessively high and the water was expected to cause increasing to severe sodicity problem when used in irrigation. Generally the water of these drains could be used in irrigating the soils of this area during the period from March to mid-January i.e. before the winter closure, taking into consideration the application of the appropriate leaching requirement, efficient drainage system, addition of gypsum either to soil or to water and the selection of the crop that suits the level of salinity.

The analysis of groundwater showed that the water sampled from the observation wells distributed throughout the area could be divided into two groups. The water of the first group could be classified as non saline to moderately saline, while that of the second group was moderately saline through most of the year and even highly saline in some months. From the sodicity point of view, there were great variations in the values of the adjusted SAR among different wells, for each well, however, the values differed widely with months of the year.

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مكتب رئيس مجلس الادارة

# Conclusions of the Second Evaluation of the Professional Employee Exchange Program That Took Place During the Period

25 May- 1 June, 1983

The second project evaluation cessions took place in Cairo during the period May 25 - June 1, 1983. The SRP delegation was composed of:

| | |
|---|---|
| Mr. Marcel Boulais | Vice President |
| Mr. Jack Phister | General Manager |
| Mr. Bob Mason | Director, Water Group Management-Staff |
| Mr. Ed Kirdor | Supervisor, Special Water Studies, |

From the Ministry of Irrigation side the following members participated:

| | |
|---|---|
| Mr. Wageh Abbass | Senior Under Secretary of State. |
| Mr. Mahmoud Abu-Zied | Chairman, Water Research Center |
| Mr. Hassan Wahby | Director, Water Management Research Institute. |
| Mr. Farouk Shahin | Director, Training Departement. |

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From: CID

Mr. Gene Quinmen

During the discussions the following issues were concluded:

1. An evaluation and review of Phase I took place. The consenses of opinion among all parties is very satisfactory. The Ministry of Irrigation feels That the program is successful and a word of tanks and appretiation is due to all SRP officials for their interst and assistance.

   The Ministry of Irrigation officials realize that the SRP has accepted the exchange program concept not for any monetary gain (in fact, the program has been costing SRP significantly). The program has created an opportunity for MOI participants to observe and attain a hands-on working knowledge of SRP. They gained an understanding of the basic requirements to modernize existing irrigation projects as well as to construct and operate new irrigation systems.

2. The Ministry of Irrigation has a great desire to extend the program for a second phase.

3. It was agreed that Phase II should be oriented and concentrated on specific issues. It has been

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Suggested that the following subjects should take priority:

a. Data Communication
b. Water Measurments
c. Operation and Mantaince
d. Project management and management reporting (including preparation of annual reports).
e. Design of Irrigation Structures.
f. Management and decision making process
   - Development of ideas for improvement
   - Gathering relevant information
   - Analysis of information
   - Making a decision
   - Action or implementation of the decision.
   - Evaluation.
g. Conjunctive use of surface and groundwater

Further issues could be added if they are identified by the Ministry of Irrigation.

4. The present project US administration(CID)is satifactory and it is recommended that CID would continue to act as a program executing agency for Phase II.

5. The Ministry of Irrigation realizes that, to date, no compensation has been made to SRP to cover in-house costs of the program. The SRP project management has indecated during discussions that the project will continue to do so for Phase II. This attitude was highly appreciated by the MOI.

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However, it was felt logical that program direct costs will be reimbursed.

6. Concerning the details of the proposed Phase II, the following issues were agreed upon:

a. The period of the new agreement should be from June 1984 to June 1988. Periodical evaluation should be made to determine viability of the program. A minimum of one evaluation a year is proposed.

b. A ratio of American echangees to Egyptian of one to four is suggested. Follow-up visits, or for in-depth training, by team members who have been to SRP or Egypt previously are accepted. This may be modified by mutual agreement for special issues.

c. Exchange of MOI-SRP employees should range from 6 to 12 weeks in duration depending on the issue for training emphassis.

d. Training groups should consist of 2 to 4 persons from each side, at least two should be assigned to a given issue.

e. For SRP teams it is suggested that they get prepared for giving at least one seminar upon their arrival to Egypt explaining their

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experience and proposed workplans. It is expected that MOI teams be prepared for a similar action.

7. USAID has indecated willingness to consider the proposed Phase II Whenever it is submitted by the MOI.

It was agreet that MOI will prepare a proposal for Phase II that could be send to SRP for reviewing (specially from the budgetary point of view).

8. SRP officials feel that the coming visit of H.E.Samaha to the States next September would give an excellent chance for signing Phase II agreement with the participation of USAID and the executing agency.

9. The subject of summer Engineering Student work and training program for the Zagazig Department of Irrigation was discussed. SRP officials indecated their acceptence to accomodate two every summer for last-year students where travel expenses be taken care of by participants and support be given by SRP in Arizona.

| SRP Review & Evaluation Team | MOI Review & Evaluation Team |
|---|---|
| M. J. Boulais | W. A. Abulatta |