THE ARAB REPUBLIC OF EGYPT

MINISTRY OF IRRIGATION

FINAL REPORT

ON

FEASIBILITY STUDY

FOR

THE SOUTH HOSAINIA VALLEY AGRICULTURAL DEVELOPMENT PROJECT

(MAIN REPORT)

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MARCH 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request of the Government of Arab Republic of Egypt, the Japanese Government decided to conduct a survey on South Hosainia Valley Agricultural Development Project and entrusted the survey to the Japan International Cooperation Agency. The J.I.C.A. sent to Egypt a survey team headed by Mr. Ikuzo Iwamoto from July 19 to November 17, 1980.

The team exchanged views with the officials concerned of the Government of Arab Republic of Egypt and conducted a field survey in South Hosainia Valley area, in Egypt. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Arab Republic of Egypt for their close cooperation extended to the team.

March, 1981

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Mr. Keisuke Arita
President
Japan International Cooperation Agency (JICA)
Tokyo, Japan

Dear Sir,

We are very pleased to submit herewith the final report on the Feasibility Study for the South Hosainia Valley Agricultural Development Project in the Arab Republic of Egypt.

As for the Project Study, the field surveys had been carried out for four month from July in 1980, and during stay in the Project site, the survey team had frequently held many discussion meetings with the Egyptian authorities concerned in connection with the project planning and report has been compiled in Japan with the results of said procedures.

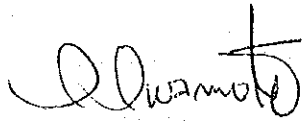
The objectives of the study are to be made the developed plan on the irrigated agriculture development involving the On-Farm Development programme in the South Hosainia Valley area (31,400 hectare) which are inclusive of the new five years development plan in Egypt (1978 - 1982).

We are convinced that the successful agricultural development in the area, when realized according to the direction indicated in this report, would greately contribute to the socio-economic development of the country in future.

We wish to extend our deep gratitude to the Ministry of Irrigation, Ministry of Land Reclamation and Ministry of Agriculture of the Governments of Egypt, and the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan, and the Japan International Cooperation Agency (JICA), especially for the Japanese Embassy in Cairo, Cairo Office of JICA, and the advisory group which are given useful advices to the survey team from time to time so as to smoothen the study.

Sincerely yours,

March, 1981



IKUZO IWAMOTO
Leader of the Feasibility Study
Team for the South Hosainia Valley
Agricultural Development Project

GENERAL PLANNING MAP

LEGEND

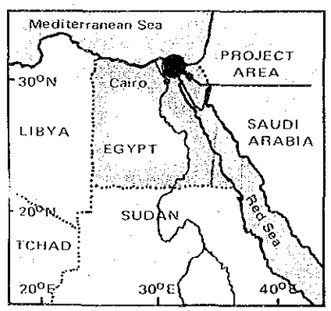
- DIVERSION FACILITY
- IRRIGATION CANAL
- DRAINAGE CANAL
- FEEDER ROAD
- VILLAGE ROAD
- SMALL VILLAGE
- SERVICE VILLAGE
- CENTRAL VILLAGE
- PUMPING STATION FOR DRAINAGE
- PUMPING STATION FOR IRRIGATION
- LIVE-STOCK CENTER

Bahr Saft drain

El Salam canal

Bahr Baqar drain

KEY MAP



SCALE

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ABBREVIATIONS AND GLOSSARY

ARE	:	Arab Republic of Egypt
B/C	:	Benefit Cost Ratio
CIF	:	Cost, Insurance and Freight
EIRR	:	Economic Internal Rate of Return
ET	:	Evapotranspiration
FAO	:	Food and Agriculture Organization
FC	:	Foreign Currency
FOB	:	Free on Board
FY	:	Fiscal Year (July 1st to June 30th)
IBRD	:	International Bank of Reconstruction and Development
JICA	:	Japan International Cooperation Agency
K	:	Potassium
LC	:	Local Currency
LE	:	Egyptian Pound = 1.4 US$ = 300 Japanese Yen
MOA	:	Ministry of Agriculture
MOI	:	Ministry of Irrigation
MOLR	:	Ministry of Land Reclamation
N	:	Nitrogen
O & M	:	Operation and Maintenance
P	:	Phosphorous
$, US$	:	Dollar, US$ = 0.74 LE

Units of Measurement

Length

mm	:	millimeter
cm	:	centimeter
m	:	meter
km	:	kilometer

Area

sq.cm, cm^2	:	square centimeter
sq.m, m^2	:	square meter
sq.km, km^2	:	square kilometer
MSM, $10^6 m^2$	:	million square meter

Volume

ℓ, lit	:	liter
cu.m, m^3	:	cubic meter
MCM, $10^6 m^3$	:	million cubic meter

Weight

g	:	gram
kg	:	kilogram
ton, m.t.	:	metric ton

Others

EL	:	elevation above mean sea level
MSL	:	mean sea level
FWL	:	full water level
HWL	:	high water level
LWL	:	low water level
sec	:	second
minu	:	minute
hr, hrs	:	hour or hours
min	:	minimum
max	:	maximum
%	:	percent
PPM	:	part per million
No.	:	Number
°C	:	degree centigrade
°F	:	degree fahrenheit
Cl	:	Chlorine
HP, PS	:	Horse Power
lit/sec	:	liter per second
m/s	:	meter per second

Conversion Factors

Unit	Comparison
Units of Length	
Millimeter (mm)	0.001 meter
Centimeter (cm)	0.01 meter
Meter (m)	100 cm
Kilometer (km)	1,000 meters
Units of Area	
Square centimeter (sq.cm)	0.0001 sq.m
Square meter (sq.m)	
Hectare (ha)	10,000 sq.m
Square kilometer (sq.km)	1,000,000 sq.m
Feddan	4,200 sq.m
Units of Volume	
Cubic centimer (cu.m)	0.001 cu.m
Liter (1,000 cu.m)	0.001 cu.m
Cubic meter (cu.m)	1,000 liters
Units of Weight	
Gram (g)	
Kilogram (kg)	1,000 g
Metric Ton (mt)	1,000 kg

Miscellaneous

1 cu.m per sec	=	1,000 liters per second (ℓ/s)
	=	35.3145 cu.ft per second (cfs)
	=	15,850 gallons per minute (gpm)
1 liter per second for 1 day	=	8.64 mm depth over one hectare
10 mm depth over 1 hectare	=	1.157 liters per second for 1 day
	=	3,532 cu.ft
1 horsepower (metric)	=	75 kg-m per second
	=	550 ft-lb per second
1 cu.m per day per feddan	=	0.238 mm/day = 2.38 ℓ/day/ha

SUMMARY, CONCLUSION AND RECOMMENDATIONS

SUMMARY, CONCLUSION AND RECOMMENDATIONS

A. Summary

1. Background

The Government of Egypt formulated the New Five-Year Plan, started in 1978, so as to expand its national economy quantitatively together with creation of the employment opportunities. The Five-Year Plan includes the El Salam Canal Project and the irrigated agriculture development project with farm land reclamation for the area of 196,000 feddans (about 82,300 ha) as well. The South Hosainia Valley Agricultural Development Project involved in the El Salam Canal Project, was considered most promising in its feasibility with the highest priority.

The Government of Egypt has requested the Government of Japan for technical cooperation to promote early implementation of a number of agricultural development projects including the South Hosainia Valley Agricultural Development Project. In responese to the request, the Government of Japan dispatched a survey team headed by Mr. Jinpei ISHIZAKA (Ministry of Agriculture, Forestry and Fisheries, Japan) to the field, and frequent discussion meetings with Egyptian authorities concerned have led to the conclusion that the feasibility study for the South Hosainia Valley Agricultural Development Project has taken up with highest priority. Along with this policy, the Government of Japan dispatched a preliminary survey team to the country in February, 1980, and a S/W mission in July, 1981, prior to full-scale execusion of the feasibility study. According to these surveys, the feasibility study team comprising 12 experts was sent to the field in the end of July, 1980 for conducting a variety of field investigation and studies for a period of 120 days.

2. Location and Area

The South Hosainia Valley Agricultural Development Project Area is situated in the northeast of the Nile Delta, about 25 km west of the Suez Canal and about 150 km northeast of the Greater Cairo, in developing as the flat desert land in the extent of about 25 km from east to west and 15 km from north to south. However, one third of the Project Area is swampy

due to being affected by the Manzala lake. The Project covers 74,000 feddans (about 31,400 ha), including the existing farm lands of 6,000 feddans (about 2,500 ha) in the western part (along the Saft drain) and the southern hilly part of the Area. These farm lands, however, are difficult in stable irrigation water supply, suffering from low agricultural productivity.

Very few road facilities are observed in the Project Area but the national road running to the Greater Cairo via San El Hagar, new village developed westerly adjacent to the Project, and another road, unpaved yet, is constructed along the Bahr Baqar which is the boundary of the eastern part and the southern part of the Area, to be linked with the national road.

3. Natural Conditions

The Project Area, in general, dips gently toward northeast at the slope of less than 1/5,000, and the northern and the northeastern parts lie flat, while southern and the southwestern parts are hilly lands at the elevation ranging from to one to three meters including several hills at the elevation of about ten meters. Along the western, the eastern and the southeastern parts of the Area, there flow the Saft drain, the Bahar Baqar drain, and the Ramses drain, a branch of the Saft drain, flows in the Area. The water discharged in these canals is unsuitable for irrigation purpose due to high salinity concentration and degradation in quality.

The climate of Egypt is roughly classified into two patterns; the semi-tropical climate prevailing in the southern arid zone and the Mediterranean Sea climate prevailing in the northern part. The Project Area, located in the northern part, is exposed to the Mediterranean Sea climate with mean annual temperature by 20.4°C, the minimum by six degree centigrade in January and the maximum by 45°C in June. The mean annual rainfall is recorded by about 50 mm/year, about 50 percent of which takes place in December and January. Evaporation, which has a considerably high rate, is estimated at some 1,800 mm in annual total.

4. Soils

The geology of the Project Area is characterized by fluvio-marine alluvial deposits of mostly fine texture which were transported by the Nile river, forming the most north-easterly part of the Delta. Martrixes soil material are originated from the strata of sandstone and granite distributing along the River in the Lower Egypt. The general texture is clay-silty down to about 13 m from the surface followed by sandgravelly subtratum.

Most of the lands are covered with a very thin wind-blown sand (rather silty and clayey textured), variant salt crust and puffy salty top soil.

5. Present Agriculture

A greater part of the Project Area is covered with desert lands and only 6,000 feddans (2,500 ha) of farm lands are seen along the Saft drain, where the irrigated agriculture has been carried out under the guidance of the Egyptian authorities concerned. The major crops grown therein are paddy, maize and cotton in summer, whereas berseem and wheat in winter. The average yields gained at present are about 6 ton/ha for paddy, 3.2 ton/ha for wheat, 3 ton/ha for cotton and 4.2 ton/ha for maize according to the data available at Sharkia Governorate.

In Egypt, land holdings per farmer are averaged at three feddans (about 1.2 ha) whereas the average land holdings per farmer in the Project Area are estimated at four to six feddans (about 1.7 to 2.5 ha) slightly larger than the national average. On the other hand, some farmers have been doing their works in additional leased land to their own holdings.

Agricultural extension services have been rendered by the Ministry of Land Reclamation and the Ministry of Agriculture. In the services, certain lands owned by particular owners in small villages are well used as demonstration farms for giving guidance to the farmers concerned.

The farmers' organization is formed on the committee provided in

small villages, which plays a vitally important role in various aspects of administration and guidance of the farmers.

6. The Project

1) Objectives and Components of the Project

The objectives of the Project are to increase agricultural production and employment opportunities for the local farmers through expansion of farm lands by carrying out land reclamation as well as to consolidate the living environment of the farmers. For these objectives, the Project is composed of the following plans;

i) Agricultural development plan

- ° Irrigated agriculture development
- ° Introduction of animal husbandry
- ° Establishment of the farmers' organization

ii) Plan for civil works

- ° Irrigation/drainage facilities
- ° Land consolidation
- ° Road networks

iii) Rural community development plan
(Excluding construction cost of this plan)

2) Agricultural development

i) Land use plan

The proposed land use for the Project is shown below.

Net cultivation area:	49,700 feddans	(20,900 ha)
Others: 1/	25,000 feddans	(10,500 ha)
Total	74,700 feddans	(31,400 ha)

ii) Major crop

Summer crops: Paddy, cotton, maize

Winter crops: Wheat, berseem

Note: 1/ Right of way of roads, canals and on-farm facilities, non-arable waste lands and residential area.

iii) Cropping intensity

The cropping intensity is estimated at 200 percent on the annual basis.

iv) Target yields

Paddy:	7.1 ton/ha		
Cotton:	3.0 ton/ha		
Wheat:	4.3 ton/ha		
Maize:	5.3 ton/ha - soiling corn:	60.0 ton/ha	
Berseem (4-times cutting a crop season):		57.0 ton/ha	
(2-times cutting a crop season):		28.5 ton/ha	

v) Annual production

Paddy:	48,969 ton
Cotton:	20,691 ton
Maize:	18,831 ton
Wheat:	29,657 ton
Berseem:	595,650 ton
Soiling corn	213,180 ton

vi) Animal husbandry

Proposed breeding head of beef cattle

Calves	26,520 head
Raising	26,520
Cattle	35,360
Total	88,400

Lands required for facilities of animal husbandry are secured within non-arable land by 700 feddans (about 300 ha).

vii) Farmers' organization

Out of many farmers living on farm lands commanded by three tertiary canals, 60 farmers are formed into one group as a unit of farmers' organization and one small village will involve five to seven groups, accordingly. A representative or a leader selected from 60 farmers shall be a chief of the group to administer the group in extension services, water management, etc. Small villages and service villages shall provide a board of committee to be composed of these small village chieves.

3) Agricultural Infrastructure Plan

i) Irrigation/drainage canals

Alignment of the irrigation/drainage canals are determined based on the topographic map on a scale at 1/10,000. The canal length and the pumping facilities are outlined as under.

Irrigation Canal		
Main Canal	38.7 km	
Secondary Canal	284.5	
Total	232.2	(6.5 m/feddan) (15 m/ha)
Drainage Canal		
Main Canal	44.4 km	
Secondary Canal	251.2	
Total	295.6	(5.9 m/feddan) (14 m/ha)
Booster Pumps	4 stations (18 sets)	ø : 500 - 800 mm
Pumps for Returnflow	2 stations (6 sets)	ø : 700 - 800 mm
Drainage Pumps	1 station (3 sets)	ø : 1,000 mm

ii) Land consolidation

The standard plot size is 210 meters in length of run and 100 meters in width. Each plot shall provide farm ditch and drain as well as have land levelling.

The work volume is estimated based on the standard plot with necessary facilities and the estimation obtained thereform is applied to the computation of the total work volume of on-farm facilities for the Project. However, for volume of land levelling, the sample areas are selected to be classified by topographical conditions and slopes and the specific land levelling work volume is estimated according to the respective conditions.

iii) Road plan

The Project will construct the road networks specified as below.

Trunk road	41.5 km	
Village road	82.0	
Farm road	1,205.0	
Total	1,328.5	(26.7 m/feddan) (64 m/ha)

4) Rural development plan

The study is made on location of the villages or settlements to be constructed in the Project Area and necessary facilities for the respective villages and such public facilities for regional requirements as water supply, power supply and distribution, telecommunication, etc. The cost to be required for this plan has been excluded of the cost for economic evaluation of the Project although estimated separately.

5) Implementation and Operation and Maintenance

The Ministry of Irrigation and the Ministry of Land Reclamation will be the executing bodies of the Project. However, a coordination committee should be established to make smooth execution of the works under good coordination of the both organizations. The Project implementation is planned to take five (5) years excluding preparatory works. The both organizations should provide the Project field offices at site, respectively. The construction works should be entrusted to the companies (corporations) having relations to the Ministry of Irrigation.

Upon completion of the construction works, the Project shall be transferred to the Operation and Maintenance offices of the respective organizations, and the Operation and Maintenance services should be rendered under the close cooperation with the regional organizations in the Project Area.

6) Project cost

The total investment cost including annualy ten percent of price escalation cost during construction period amounts to LE 84,515 thousands, of which LE 42,509 thousands are the foreign currency portion and LE 42,006 thousand are the local currency portion. The cost per ha is estimated at LE 4,044/ha ($5,777/ha equivalent).

7) Project Evaluation

i) Method of evaluation

The economic feasibility of the proposed project is evaluated with both the direct benefit and cost which can be assessed in monetary terms. From an economic point of view, it is evaluated by those incremental benefit and cost between two cases, namely with project and without project. The primary benefit of the proposed project is an agricultural benefit, which can be estimated in terms of annual increment of net production value.

ii) Agricultural benefit

The agricultural benefit consists of two. The one is a benefit gained by cultivating such crops as paddy, cotton, maize and wheat. The other is that gained by producing beef cattle which are fed by such fodder crops as soiling corn and berseem.

In 1997, the following production would be expected.

	Without Project (ton)	With Project (ton)	Incremental (ton)
Paddy	4,640	48,969	42,329
Cotton	880	20,691	19,811
Maize	-	18,831	18,831
Wheat	1,280	29,657	28,377
Beef Meat	-	7,956	7,956

By applying economic farmgate prices, the incremental net production value is estimated at LE 18,672 thousand in total, which will be attained in the 16th project year.

iii) Project cost

The project cost involves initial cost, operation and maintenance cost and replacement cost. The financial initial cost is estimated at LE 84,515 thousand of which LE 24,822 thousand is price escalation.

The economic project cost is obtainable by reassess such items as interest, tax, compensation, subsidy, etc., in the financial project cost. The economic initial cost is estimated at LE 51,111 thousand (US$73,016 thousand) of which LE 29,332 thousand (US$41,903 thousand) is foreign currency portion and the rest LE 21,779 thousand (US$31,113 thousand) is local currency protion.

iv) Economic evaluation

By discounting both streams of economic benefit and cost over the project life at several discount rates, 16.3 percent of economic internal rate of return has been worked out which definitely shows the proposed project economically feasibile.

v) Farm budget analysis

The farm budget analysis proves that every farmer will maintain their subsistence level of living upto 26th year after settlement and enjoy their desirable level of living from 27th year and further, and eventually obtain their farmland and house as their property.

B. Conclusion

As an important factor of the long-term development plan prepared by Egyptian Government, the South Hosainia Valley Agricultural Development Project has been studied economically and technically through comparing various alternatives, and the thorough study has come to conclusion that the above plan is the best available in every respect. The Project under the above plan will make farm land formation for the area of 49,800 feddans (about 20,900 ha) and be promising in upgrading of the living standard of about 88,000 inhabitants in the Area.

C. Recommendations

1. Surveying and study

The surveying and study on the following items are essentially required for successful execution of the detail design.

1) Surveying and study for civil works

   i) Irrigation/drainage canal: Section/profile surveying for main/lateral canals

   ii) Geological survey on the structure construction site

2) Test embankment shall be carried out for canal embankment works and the adequate specifications shall be prepared.

3) As for diversion from the El Salam Canal, check structures should be provided to prevent intake water level from fluctuating.

4) It should be considered to take countermeasures for preventing the roughness coefficient of the canals from decreasing.

5) A careful attention should be paid to using salt-resistant materials for pumps and other steel-made structures.

2. Soil Investigation

Based on the results of the soil survey some recommendations are described as follows on the land reclamation and soil improvement.

1) Because of the extreme accumulation of salts ranging from 300 to 1,800 tons per ha within one meter depth of the soil, sufficient leaching water should be used at a rate of five times to the soil depth, that is, two meters of water in total to the upper 40 cm soil so that electrical conductivity of soil water would decrease to around 4 mmhos. Quantity of water can be saved depending on the leaching method and salinity of soil type.

2) Shallow leaching method with intermittent use of water followed by depening the ditches is recommended. Excess leaching should be avoided not to cause pH increase and clay dispersion that will result in impermeability of the subsoil. At an early stage of leaching somewhat saline water shall be safely irrigated.

3) Concerning soil amendments, gypsum supply would better be withheld because of overall high gypsum content of the soil. Mixing sand or sandy soil with the clayey surface soil is very effective on increasing permeability and workability of the land.

4) After land reclamation the cropping will need some application of nitrogen fertilizer followed by phosphate fertilizer while potassium can be waited for some period of rotation.

5) There is pointed out need for continued studies on the better leaching method, behaviour of soil gypsum in its ion-exchange activity and probable manganese toxicity in the reduced status of the soil.

3. Agriculture

1) After completing the proposed three-year crop rotation several times, the possibility of diversifying the cropping pattern should be studied by conducting intensive analysis of edaphic and some other environmental factors in order to determine the feasibility of introducing some marketable vegetables, oil crop, etc. into the Project Area.

2) Economic costs for the rice seedling preparation and transplanting should be reduced by widening the current paddy transplanting interval up to about 30 cm x 20 cm and reducing the nursery area required for the unit main field area.

3) The possibility of introducing rice transplanting machines into the Project Area should be studied in the future through taking into consideration the possibility of transfering technologies on seedling preparation, physical workability of the soils, etc.

4) The effects of phosphorus fertilization on wheat and maize yields should be studied in the Project Area.

CHAPTER I INTRODUCTION

CHAPTER I. INTRODUCTION

The Government of Egypt requested the Government of Japan for cooperation in promoting the South Hosainia Valley Agricultural Development Project, the Area of which is part of the land covered by the El Salam Canal Project now under way. The Government of Japan, in response to the request, has been positively extending technical and financial assistances in dispatching a preliminary survey team for studying the Project proposed in parallel with frequently holding the discussion meeting with Egyptian authorities concerned to look into the best available strategy. As a result, a study team was sent to the field to conduct the feasibility study for the South Hosainia Valley Agricultural Development Project. (hereinafter "the Project")

The Project is expected to be most promising of various irrigated agriculture development projects involved in the El Salam Canal Project. The Project components are construction of irrigation/drainage facilities including farm land formation, road construction, agricultural development, establishment of farmers' organizations including extension service system, and rural development.

The report covers a variety of items agreed upon by both governments as the scope of works, the outline of which is described as follows;

1) to pursue the comprehensive development possibility of the Project Area according to the collected data and information available, in supplementing necessary data from time to time,

2) to prepare a topographic map on a scale at 1:10,000, covering about 74,700 feddans (about 31,400 ha equivalent) of the Project Area,

3) to determine the following basic matters for formulating the development plan of the Project Area.

i) Project boundary
ii) Land use plan
iii) Cropping pattern
iv) Water requirement
v) Irrigation/drainage networks
vi) Effective leaching method
vii) Target yield
viii) Plan for execution of public works, etc.,

4) to make a preliminary design for the Project to estimate the project cost, evaluate the project benefit and formulate physical planning for public works, and

5) to conduct an economic evaluation of the Project and formulate an implementation program of the Project.

The feasibility study for the South Hosainia Valley Agricultural Development Project has been conducted along with the above-outlined Scope of Works.

The members of the supervisory group, the Feasibility Study Team (hereinafter "the team") and the Egyptian Government officials contacted during the field survey of the Team, are listed as follows;

Supervisory Group Assigned to the Project

1.	Chief Advisor *Mr. Jinpei ISHIZAKA*	Director General, Aizu Irrigation Project, Tohoku Regional Office, Ministry of Agriculture, Forestry and Fishary (MAFF)
2.	Adovisor (Irrigation & Drainage) *Mr. Nobuyoshi OCHIAI*	Deputy Manager, Planning Section, Planning Department of Public Corperation of Water Resources Development
3.	Advisor (Agro-Economy) *Mr. Naomi INAGE*	Advisor, Planning Division, Tokai Regional Office of MAFF
4.	Advisor (Agronomy) *Mr. Yasutake UCHIYAMA*	Chief Resercher, Reserch Institute of Tropical Agriculture

5. Advisor (On-Farm) *Mr. Yasuo ICHIKAWA*	Deputy Manager, Supervision Section, Structural Improvement Bureau of MAFF
6. Advisor (Finance) *Mr. Toomi SHIBUICHI* *(Mr. Nobuo KANAMORI)*	Deputy Manager, Development Section, Development Division, Overseas Economic Cooperation Fund

Member List of Survey Team

1. Team Leader	Mr. Ikuzo IWAMOTO
2. Irrigation & Drainage	Mr. Masahiro IIDA
3. Design	Mr. Hideyo KANETANI
4. Soil	Dr. Yasuo TAKIJIMA
5. Agronomy	Mr. Kazuaki SATO
6. Rural Development	Mr. Katsuyuki AKAGAWA
7. On-Farm	Mr. Toshihiko HIRAGA
8. Agro-Economy	Mr. Yoshitomo MIYANISHI
9. Survey	Mr. Mitsuo KUNIYA
10. Survey	Mr. Souichi ICHIKAWA
11. Survey	Mr. Kaoru SUZUKI
12. Survey	Mr. Masahiko TANIGUCHI

Egyptian Government Officials Contacted by the Team

I. Ministry of Irrigation (MOI)

1. Eng. Amin Makhlouf	First Undersecretary of MOI (Overall Coodination)
2. Eng. Hussan Lashein	Director General of Eastern Delta Extension Project, Zagazig
3. Eng. Yousry Shafick	Assi't Director General of Eastern Delta Extension Project, Zagazig
4. Eng. Zakimino Mrkhark	Chief Engineer of Eastern Delta Extension Project, Zagazig
5. Eng. Abdel Mamied Bahtiti	Design Engineer of Eastern Delta Extension Project, Zagazig

II. Ministry of Land Reclamation (MOLR)

1. Dr. Rifki Anwar	Counsellor of MOLR, Cairo

2.	Eng. Mohamed Salek Moaward	Director General of ARAD, MOI, CAIRO
3.	Eng. Youssny Wissa	Director General of Technical Study of Project Planning, MOLR, CAIRO
4.	Dr. Mohamed Ramadan	Economist of MOLR, CAIRO
5.	Eng. Mohamoud Abd El Rahman	Agronomist of MOLR, CAIRO
6.	Eng. Nabi Hawas	Director of Planning of Buildings, MOLR, CAIRO
7.	Eng. Hanafy Farag	Director of Mechanical, MOLR, CAIRO
8.	Eng. Hosny El Eraky	Director of Excution, MOLR, Zagazig
9.	Eng. Abd El Rohman Darwish	Director General of San El Hagar Sector, San El Hagar
10.	Engl. Abedlel Rahman El Agamy	Assit Director General of San El Hagar Sector, San El Hagar
11.	Eng. Yausef Said	Agricultural Engineer of San El Hagar Sector, San El Hagar

Other Agencies

1. Dr. Yahia Mohy El Deen	Director of Agriculture Economy Institute, Under Secretary, MOA, CAIRO
2. Dr. B. G. Bishay	Institute of Soil and Water Research, Ministry of Agriculture
3. Eng. Mohammed Shawky El-Beltegy	Director General of Sub Station Design. Egyptian Design Institute Rural Electrification Authority
4. Eng. Aly Swaky	Director of Planning. Egyptian Design Institute Rural Electrification Authority

CHAPTER II NATIONAL ECONOMY

CHAPTER II. NATIONAL ECONOMY

II-1. General Description

1) Land

The Arab Republic of Egypt is located on the northeastern corner of the African Continent, and is contiguous to the Western Asia through the Sinai as well as to the European Continent beyond the Meditaranean Sea. She has played an important role as a strategic position for both traffic and military affairs.

Egypt is bordered on the south by Sudan in latitude 22°N, the west by Libya in Long. 25°E, the north by the Meditaranean Sea, and the east by the Red Sea. She has an area of about 1,000 thousand sq.km, and is located on the central portion of the desert which is stretching over the Arabian Peninsula through the Northern Africa.

Only four percent of the total land, or about 36 thousand sq.km is presently developed and utilized as arable land and permanent residence, and most of all these land is located along the Nile River valley, on the Nile Delta and the oases which are scattered in the country.

2) Demography

According to statistics, total population in July 1978 is estimated at 38,448 thousand excluding 1,434 thousand of population abroad, of which 51 percent or 19,591 thousand is male and 49 percent or 18,857 thousand is female. Although population density against total land is about 38 per sq.km, that against the arable land and the residential area (about 36 thousand sq.km) is 1,074 per sq.km.

Annual population growth rate is 2.4 percent since 1952 and also about 2.4 percent over the last ten years period. The growth rate of 2.4 percent per annum is not so high compared with those in other African countries, but pressed the recent economic development in Egypt.

According to the population census in November 1976, about 44 percent or 16,089 thousand is dwelling in urban area and about 56 percent or 20,567 thousand does in rural area. Recently it has been seen that population movement from rural area to urban area to seek employment opportunities, because the agricultural sector may not absorb incremental workable population in rural area.

In 1977, total labor force is estimated at 9,719 thousand of which about 42 percent or 4,103 thousand is engaged in the agricultural sector. While the total labor force grew at 2.2 percent per annum during the period between 1972 and 1977, the agricultural labor had slightly decreased from 4,134 thousand to 4,103 thousand during the same period.

3) Administrative Boundary

Egypt is administratively composed of 25 governorate and governorate is sub-divided into districts. The project area is belonging to Sharkia governorate of which capital is Zagazig.

II-2. Macro Economic Performance

1) General

Since introduction of Egypt's "Open-Door Policy" in 1972, her economy has considerably improved through recovery of petroleum production as well as more output gained by such industrial sectors as metal goods, textile goods, foods and so on. On the other hand, it is the fact that there has happened many serious troubles or difficulties in her economy, namely, while importation of capital goods and intermediate goods has increased through more investment activities for economic development, growth of production was rather low in comparison with degree of investment expansion, and export found it hard to grow. Furthermore, to comply with stabilization of public welfare as well as population growth with 2.4 percent per annum, importation of consumer goods has increased, and eventually deficit in foreign trade balance has sharply increased.

2) Gross Domestic Product

As shown in Table II-1, G.D.P. in 1977 is estimated at L.E. 7,341 million and L.E. 5,780 million at current prices and at 1975 constant prices, respectively. The real growth of G.D.P. between 1973 and 1977 is 6.3 percent per annum. On the other hand, G.D.P. per capita in 1977 is L.E. 149.2 which is equivalent to US$381 by using the market exchange rate in 1977, and its real growth between 1973 and 1977 is 4.1 percent per annum (For further details, reference is made to Annex A).

3) Price Indices

According to statistics, price indices in Egypt show annual increasing rate of over ten percent for consumer prices as well as wholesale prices. During the period between 1973 through 1978, annual growth rate of each prices are shown below;

Prices	Annual Growth Rate (%)
Consumer Prices (Urban)	10.9
Consumer Prices (Rural)	12.3
Wholesale Prices	10.7

II-3. Foreign Trade

1) General

Since 1950's, Egypt's balance of foreign trade has shown a deficit, except two years of 1969 and 1973. Until 1972, the deficit was not so big amount by reason of the government's severe control on import, but it has sharply increased starting from 1974 due to rapid expansion of import for basic materials and intermediate goods, which was restricted under her wartime economy. In addition, since 1975 importation of capital goods as well as consumable goods has kept the total amount of import high level and annual excess of import amount over export's accounted for twice of the export amount (See Table II-2).

Table II-1. National Accounts

(Unit: L.E. Million)

	1973	1974	1975	1976	1977
At Current Prices					
Exports	531	890	894	1,034	1,470
Government Consumption	1,020	1,101	1,213	1,571	1,576
Gross Fixed Capital Formation	462	640	1,228	1,385	1,769
Increase in Stocks	40	90	100	195	281
Private Consumption	2,339	2,871	3,281	3,863	4,505
Imports	-729	-1,395	-1,831	-1,772	-2,260
Gross Domestic Product	3,663	4,197	4,886	6,276	7,341
Net Factor Payments Abroad	-29	-112	-148	-158	-202
Gross National Expenditure	3,634	4,085	4,738	6,118	7,139
At 1975 Constant Price					
Gross Domestic Product	4,530	4,674	4,886	5,386	5,780
(Rate of Increase (%))	-	3.2	4.5	10.2	7.3
Per Capita G.D.P. (L.E.)	127.2	128.3	131.2	142.2	149.2
(Rate of Increase (%))	-	0.9	2.3	8.4	4.9
Population (million)	35.62	36.42	37.23	37.87	38.74

Source: IMF-IFS October 1980

Table II-2. Balance of Foreign Trade

(Unit: L.E. Million)

	1971	1972	1973	1974	1975	1976	1977	1978	1979
1. Exports	343.2	358.8	444.2	593.3	548.6	595.5	668.5	679.8	1,287.8
Cotton	174.9	162.0	191.9	279.1	201.0	149.1	182.3	131.5	267.3
Long staple	126.7	100.0	109.3	154.1	124.3	119.0	136.5	99.5	174.7
Long-Medium Staple	43.0	54.4	82.6	125.0	76.8	35.7	45.8	32.0	92.6
Rice	24.8	22.1	26.2	39.7	24.4	31.0	23.4	19.9	22.1
2. Imports (c.i.f.)	399.9	390.8	361.1	920.1	1,539.3	1,489.8	1,884.3	2,632.2	2,686.0
3. Imports (f.o.b.)	363.5	355.3	328.3	836.5	1,399.4	1,354.4	1,713.0	2,392.9	2,441.8
4. Balance (1-2)	-56.7	-88.7	83.1	-326.8	-990.7	-894.3	-1,215.8	-1,952.4	-1,398.2

Source: International Financial Statistics October 1980, IMF

2) Export

Although Egyptian export depends largely on raw cotton export, which accounted for over 50 percent of her total amount of export until the mid-1960's, and about 40 to 50 percent of that until the mid-1970's, its share has recently decreased to about 20 percent in 1979 (See Table II-2).

Instead of raw cotton, since 1975 export of manufactured cotton like cotton yarn and cotton textiles has been developed by 20 percent of the total export amount, but domestic demands for such materials has also increased, and this export also showed decline trend in 1978.

On the other hand, export of fuel, especially, crude oil has recently increased its share in the total export amount, and export of crude oil would be very prosperous due to continuous expansion of its production.

Food products such as rice, vegetables, fruits, etc., occupies more than half of export for basic materials. Egypt is importing a large amount of foods and simultaneously exporting them.

3) Import

Egypt is, without exception, importing most of all goods from basic materials to consumable goods. As mentioned already, Egyptian import had sharply increased from 1974 like reaction against severe restriction of import under her wartime economy, and once subsided in 1976, but again it has been increasing from 1977 thru 1979 (See Table II-2 and for further details, refer to Annex A).

4) Balance of Payments

Egypt had kept her balance of payments even, by supplementing a deficit in balance of current account with a surplus in capital account. As reported in the previous section, Egypt's balance of trade had kept a deficit since long time, and exerted pressure upon her balance of current account. Especially, it was forced to close the Suez Canal by which Egypt had earned a considerable amount of foreign exchange, due

to Israeli occupation of the Sinai Peninsular after the third Middle-East War in 1967. Also, revenues from tourism had greatly decreased due to unstable political condition. In order to make up the deficit in balance of current account, short and medium term foreign loan had been introduced, but gradual expansion of the balance in her external debt had made amortization of principal as well as interest larger, and deteriorated the balance of capital account.

Recently, the balance of capital account has been considerably improved by introduction of foreign loans, but there happens a problem that the more foreign loans are introduced, the heavier burden is imposed on her external debt. And also, introduction of foreign loans may not always be connected with her economic development, because these foreign loans might be used to cover the deficit of the balance of capital account.

In any case, it is inevitable to improve her structure of balance of trade, that would take longer period.

II-4. Economic Development Plan

1) General

Before 1973, four series of medium and long term economic development plan were established, and implementation of comprehensive development had been tried, but every plan except the first Five-Year Plan, was not successfully accomplished due to a series of mid-east war as well as shortage of necessary capital.

Under such circumstances, the Open-Door policy has been launched as foundation in her economic policy in 1971. It was inevitable to implement a comprehensive development plan in order to reconstruct her exhausted economy under the wartime economy as well as to make her economy stable. In this regards, the 18-month transition plan was established for the preparation of her launching long-term development plan, and it was scheduled to commence Five-Year-Plan from January 1976. But the planned procurement of necessary capital in the 18 months

transition program was not fully attained. Therefore, it was not possible to accomplish the planned target, and further it required to extend the plan period one year more, because of deterioration in her balance of payments as well as more deficit in her finance.

2) New Five-Year Plan

Under such circumstances mentioned above, it was announced to newly commence a Five-Year Plan from 1978.

i) Planned target

The main objective of the new Five-Year Plan is to accelerate her economic development and it is planned to create more employment opportunity by expanding in quantity her national economy with maximum utilization of introduced external investment in both public and private sector.

Targeted annual growth of gross national products is 11.6 percent during the plan period, and it is planned to increase real G.D.P. per capita of L.E. 16 in 1977 to L.E. 250 in 1982 (For further details, See Annex A).

ii) Investment program

In the new Five-Year Plan, total amount of investment is estimated at about L.E. 12,300 million, of which about L.E. 10,000 million would be invested in the public sector and the rest, L.E. 2,300 million in the private sector. In the investment program for the public sector, it is recognized that the mining and industry sector as well as the transport and communication sector are given the highest priority, followed by the services sector and the power sector.

Investment strategy during the plan period is summarized below;

- In order to obtain quicker returns, on-going projects which are presently being invested, are given the highest priority.

- To renew the existing projects of which operation is restricted by reason of idle facilities and redemption.

- As for newly proposed projects, only those projects like fertilizers, construction materials and so on which can play an important role for the government's development strategy, are given higher priority.

- To promote and encourage participation of both domestic and foreign private investers to productive projects.

- To aim improvement of living standard of rural people through regional development.

iii) Budget during the plan period

According to the planned budget of both current and development, it is scheduled that a deficit in the current budget will be L.E. 8 million in 1980, and the budget will have a surplus of L.E. 181 million in 1981 and further L.E. 240 million in 1982. This is greatly contricuted by revenues from Suez Canal as well as oil products, and it is expected that tax revenue will increase by promotion of industrialization.

On the other hand, the development budget would not cover its expenditure even by incorporating foreign loans and direct external investment into the budget, and depend on supply of credit from domestic enterprises and individual as well as foreign private banks, amounting to L.E. 806 million in 1982.

CHAPTER III THE PROJECT AREA

CHAPTER III. THE PROJECT AREA

III-1. Location and Present Conditions

III-1-1. Location and Road System

The Project Area of about 31,400 ha is situated in the northeastern portion of the Nile dalta. Suez canal runs about 25 km east of the Project Area. Cairo city, the capital of A.R.E., is situated about 150 km south-west of the Project Area. The Project Area extends to 25 km from the west to east and 15 km from the north to south centering around the lat. 31°N and long. 32°E.

The Project Area borders on Bahr Baqar, one of the main drainage canals in the East Delta, in the east, Bahr Saft drain, a tributary of Bahr Hadous drain, in the west and El Salam canal now under construction by the Ministry of Irrigation in the north. The southern project boundary has been fixed on the border line between the newly reclaimed farm land under the Governmental land reclamation program and the non-agricultural land extending in the south of it as shown in the General Planning Map.

A national road goes to Cairo from San El Hagar which is situated in the western most of the Project Area. From this national road a road without pavement branches off, and runs along Bahr Baqar drain as if it surrounds the southern and eastern portions of the Project Area. Path for which relatively hard ground surfaces is compacted by tractor connects the above-mentioned roads and villages in the Project Area. It cannot be said that the operation and maintenance of these roads inclusive of the national road have been favorably made.

III-1-2. Population and Living Conditions

The Project Area is situated in Sharkia province, and San El Hagar is located in the western edge of the Project Area. This village has been established since some ten years ago under the land reclamation and seetlement program of the Government of A.R.E., and has functioned as a service

village for the Project Area and its neighborhood.

Farm lands of about 6,000 feddans (2,500 ha) in total lie along the Saft drain and the southern portion of the Project Area. Except the farm lands, the entire Project Area is so called a soil desert where no persons live. It is estimated that about 50,000 persons live in surrounding the Project Area. San El Hagar is most densely populated in the said areas.

Transmission lines are hardly observed in the Project Area because of a limited population though the electric power has been supplied to small areas around San El Hagar.

Drinking water supply facilities are hardly observed in the Project Area. The Government has distributed domestic water from groundwater to the surrounding villages by water trucks, however, this way of drinking water supply is not sufficient due to the difficulty of water distribution by water trucks and a limited volume of groundwater available for this purpose. At present, a pipeline for drinking water supply is under construction from Faqus to San El Hagar, however, the Project Area is out of the service area of this drinking water supply project.

III-2. Natural Conditions

III-2-1. Topography and Rivers

Except the cultivated area of about 6,000 feddans in total (or about 2,500 ha) the Project Area is occupied by submerged lands of about 29,000 feddans (12,200 ha), existing roads and others 400 feddans (200 ha) and cultivable waste lands of 39,300 feddans (16,500 ha). The Project Area has a gentle slope of about 1/5,000 to 1/10,000 towards the north-east, and is topographically divided into two portions, that is, the northern plain represented by submerged lands and the southern hilly area with an elevation of one to three meters in general. In this hilly land hillocks with an elevation of about ten meters are observed here and there. There are some ruins in the hilly area.

Some depressions in the hilly land has become salt lakes though the size of such a salt lake is so small as less than ten hectares.

The Damietta branch, a tributary of the Nile, El Salam canal, Bahr Hadous, Bahr Saft drain, Ramses drain and Bahr Baqar are the related rivers and canals to the Project Area. The Nile river, one of the water source of El Salam, flows about 80 km west of the Project Area from the south to north, and empties itself into the Mediterranean Sea. The El Salam canal is under construction. This construction aims at the irrigation water supply to about 196,000 feddans(about 82,300 ha) in the East Delta inclusive of the Project Area.

Bahr Hadous drain is one of the main drains in the East Delta. With a catchment area of about 2,300 sq.km, the annual discharge of it is recorded at about 3,000 MCM. Having a salinity of 1,200 to 2,700 PPM and a sodium absorption rate of 12 to 22, the canal water is only available for irrigation purpose if it is diluted with fresh water. However, it could be directly utilized for the initial stage of leaching.

Bahr Saft drain is the main drainage canal for the upper cultivated lands of the Project Area, and its annual discharge is estimated at 740 MCM approximately.

Branching off from Bahr Saft drain, Ramses drain flows down from the south-west to north-east within the Project Area. This canal has been constructed for navigation purpose. Bahr Baqar drain has played a role of drainage canal for Cairo and various villages in the East Delta. Its annual discharge is estimated at 1,400 MCM with an extremely small fluctuation. The water is not suitable for irrigation in its quality at present, however, it could be recycled as irrigation water when the proposed sewage treatment plants are realized in future.

III-2-2. Meteorology and Hydrology

1) General Meteorology

Climate in A.R.E. is roughly classified into, the semi-tropical climate prevailing in the southern arid zone and the Mediterranean climate prevailing in the northern mild zone. The Project Area is located in the northern part of this country, and has the Mediterranean climate.

The northern part of the country has, in general, four seasons in a year, that is, the spring from March to May, the summer from June to August, the autumn from September to November and the cool winter from December to February.

i) Observatories and Observation Period

The Project Area has no weather station. Therefore, the weather data recorded at El Mansoura station for the recent ten-year period (1969-1978) have been selected for the study among these observed at several stations.

ii) Temperature

The mean annual temperature of 20.4°C is moderate although the mean monthly temperature for the three-month period from June to August exceeds 26°C. The mean monthly temperature in January is the lowest throughout the year, and it stands at 12.6°C. The maximum monthly temperature has a similar tendency to that of the mean monthly temperature. The minimum daily temperature of 6°C is particularly low. In June the maximum daily temperature rises over 45°C in some days.

iii) Rainfall and Humidity

The mean annual rainfall is about 50 mm, and about 50 percent of it concentratively takes place in December and January.

In the five-month period from May to September, rains are hardly observed. The annual rainfalls have a considerably great fluctuation year by year.

The mean annual humidity is 60 percent. The lowest humidity is recorded during the three-month period from April to June. The averaged humidity during the period stands at some 50 percent.

iv) Evaporation, Sunshine Hours and Wind

The annual average of daily evaporations is recorded at 4.8 mm/day, which is converted into 1,788 mm/year. The maximum evaporation of 8 mm/day is observed in June whereas the minimum of 2.9 mm/day in January.

The mean annual sunshine hours are 9.3 hrs/day which is totaled to be more than 3,400 hours in a year. This value is about 70 percent higher than that of 2,000 hours in Japan. Especially the sunshine hours exceeds ten hours per day during the five-month daily period from May to September. (Refer to Figure III-1).

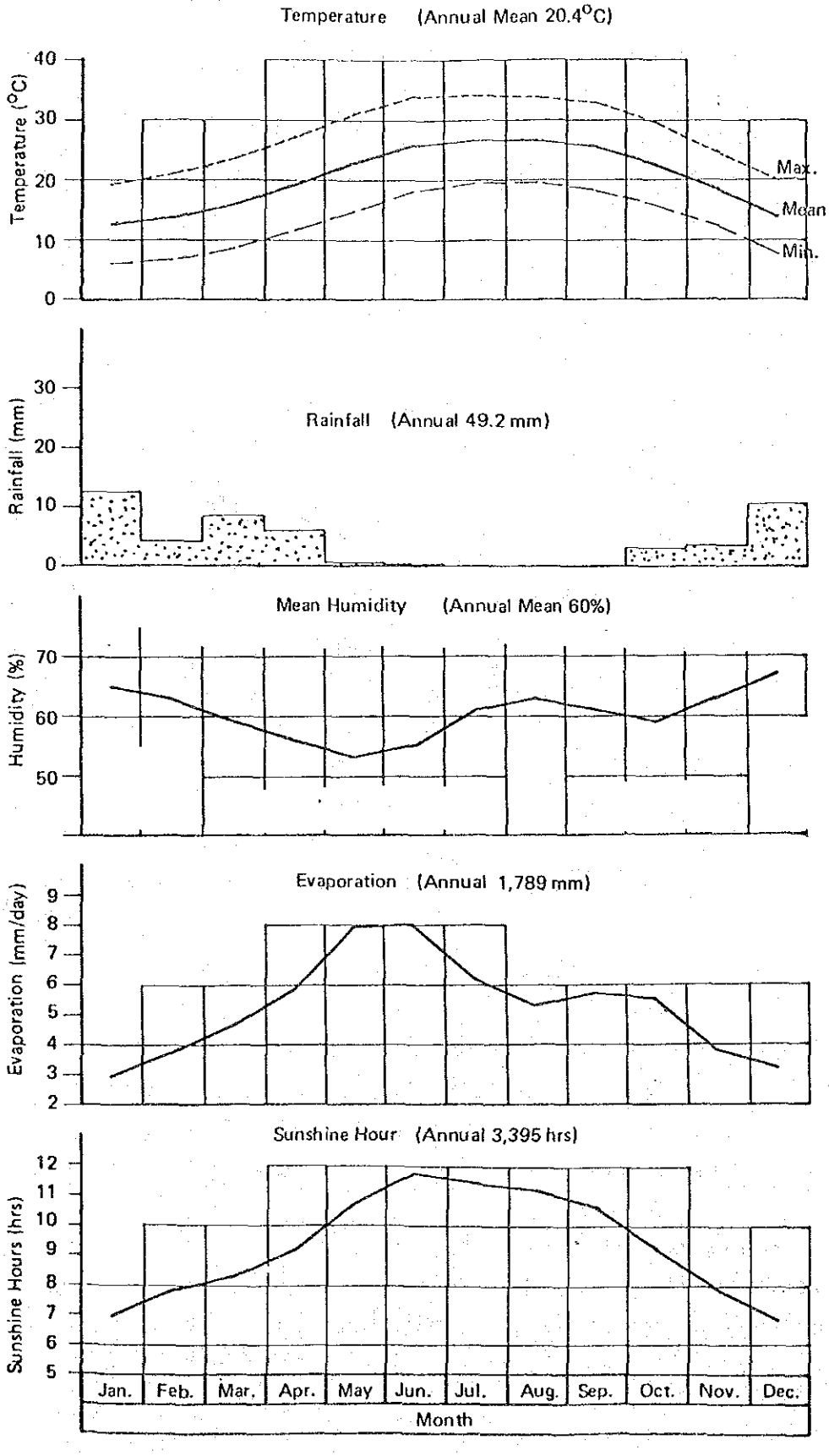
Regarding the wind, no remarkable change in its direction and speed takes place throughout the year. Only in the spring winds increase their speed to around four meters per second on an average. This wind speed is by two to three meters per second higher than that in the other seasons. The wind direction is mostly from north-west to north or to north-east except the winter season when the southwesterly winds prevail. (Refer to Figure III-2).

2) Particular Meteorology

The maximum daily rainfall of 48 mm/day took place on October 27, 1937, and the maximum temperature of 46.8°C June 18, 1933. The minimum temperature of 0°C was recorded on February 17, 1934. These records are quated from the data observed for the 30-year period from 1931 to 1960.

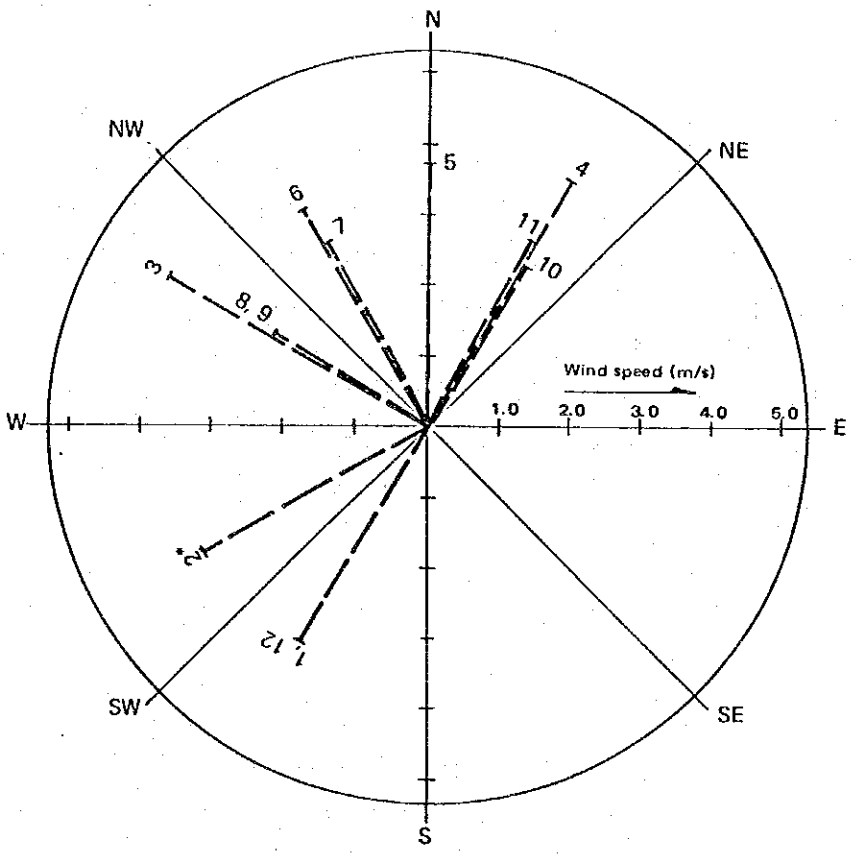
No data of natural clamities such as typhoons and torrential rains have been recorded. In April and May sand storms take place few times and last for a day at the longest, but they cause no serious damages to agricultural crops.

Fig. III-1 Meteorological Conditions



Station: El Mansoura, Observation Period: 1969 to 1978

Fig. III-2 . Wind Direction and Speed



Station: El Mansoura

Observation period: 1969 to 1978, 10 years

Note: * Month 1 – Jan., 2 – Feb., ...

3) Hydrology

Drains and canals related to the Project Area are the five courses mentioned previously inclusive of El Salam canal. Most of these drains and canals are affected by the Nile. Since the operation of barrages, pumping stations and main branch canals are made on a water distribution program, the fluctuation of discharges and water tables is very small if any.

The basic plan for El Salam Canal Project defines that, out of the monthly discharge of 237 MCM/month, 35 MCM/month (or 15 percent of the averaged discharge or about 50 percent of the monthly discharge in February) will be diverted for recycling use in the first stage whereas about 220 MCM/month (93 percent of the averaged discharge) in the final stage.

Bahr Saft drain has the annual averaged discharge of about 740 MCM/year which is converted to 63 MCM/month. In February, the monthly discharge decreases to one-fifth to one-third of the monthly averaged discharge throughout the year.

Bahr Baqar drain has the annual averaged discharge of about 1,380 MCM/year which is converted into the monthly average of 115 MCM/month.

Due to the absence of the observation data of discharge in Ramses drain, detailed information on this drain is not available. In this study, the discharge capacity of this drain is estimated at 6 cu.m/sec.

4) Water Quality

Data collection for water quality of all drainage waters except that of El Salam canal was conducted in the Study in consideration of the utilization of drainage water for irrigation. However, it was found that the direct use of the water is impossible though it could be used for leaching after land reclamation.

III-2-3. Geology and Vegetation

The geology of the Project Area is characterized by fluvio-marine alluvial deposits of mostly fine texture which were transported by the Nile River, forming the most north-easterly part of the Delta. Matrixes of soil material are originated from the strata of sandstone and granite distributing along the River in the Lower Egypt. The general texture is clay-silty down to about 13 m from the surface followed by sand-gravelly subtratum.

Although with some undulating hilly lands stretching on the south-westerly side, the Area is almost flat soil desert except for several isolated low hills called "Tell" most of which are ancient ruin sites.

Most of the lands are covered with a very thin wind-blown sand (rather silty and clayey textured), variant salt crust and puffy salty top soil. They slope very gently toward Manzala lake at rate less than 0.3 percent as is shown in Table III-1.

Table III-1. Distribution of Area by Slopes

Slope %	Area		
	ha	feddan	%
< 0.1	11,940	28,400	38.0
0.1 - 0.2	6,150	14,630	19.6
0.2 - 0.3	10,190	24,250	32.5
0.3 - 0.5	2,395	5,700	7.6
0.5 - 1.0	560	1,330	1.8
> 1.0	165	390	0.5
Total	31,400	74,700	100

(Remarks: Refer to Annex C - Table C-2-1 and Fig. C-2-2)

Due to the high salinity of the lands, vegatation is limited mainly to the water-edge of the swamps that are occupying around one third of the Area.

There are growing wild plants such as Cherithe and Hadadi (Salicornia species-chenopodium), in some places sedge and Bulrush. In the flat salty lands almost no plants are visible except for on the scattered small dunes where the most salt-tolerant plant, Tarffa (Tamarix nilotica-Tamaricaceae) is growing with a few vegetations of Phragmites.

III-2-4. Soil Series and Types

Soil survey was conducted by examining the soil profiles and analysing the soil and groundwater samples taken from 58 pits (See Map C-1). The samples numbered 150 and 22 in total, respectively and were analysed in the Laboratory of Soil and Water Research Institute, Ministry of Land Reclamation at Giza.

The soils developing in the Area belong to the Solonchaks as the great soil group. They were divided into three soil series, that is, Clay Swamp (Ms), Port Said (Ps) and Manzala (Ma), according to texture of subsoil and depth of groundwater with reference to the topographical features.

Each series was further classified into three or five soil types based on its characteristics of surface salt accumulation, texture of surface soil and oxido-redox status. The results are summarized in Table III-2, and Fig. III-3 which is drawn as soil column diagram. Distribution of the types is given in Table III-3 and compiled in a attached Map C-2 scaled at 1:50,000. Distribution by slopes and by depth of groundwater were also drawn (see Annex C - Table C-4-4 and Fig. C-4-5).

Brief descriptions of each soil series and types are as follows:

1) Clay Swamp Series (Ms)

Soils of this series occupy the lowest-lying lands, corresponding to 42 percent of the whole Area, which are frequently flooded or under water all the year round. They have clay (Ms 1 and Ms 3) to silty clay loam (Ms 2) upper soil (0-40 cm) and clayey subsoil, showing gley horizon or gley spots within one meter depth. Weak to moderate blocky or platy structure; hardness 8-14. Salt contents expressed as EC of the soil saturation extract range from 14 (Ms 3) to 90 mmhos (Ms 2), the lowest among

Table III-2. Characteristics of Soil Profiles in Soil Series and Types

Soil Series	Elevation (m)	Depth of groundwater (cm)	Surface feature (cm)	Texture		Mottlings and Gley	Soil Type
				Surface (0-40cm)	Subsoil (40-100cm)		
Clay Swamp	0-0.3	0- 50	No salt crusty	C	C	(Gley spot)	Ms 1
"	0.3-0.6	50- 80	Salt crusty (0-0.4)	SiL, SiCL+C	C	Fe or Mn	Ms 2
"	"	"		C	C (SiC)	Gley horizon	Ms 3
Port Said	0.6-1.2	80-120	Salt crusty (0.4-1.0)	C (SiL, SiCL)	C (SiCL)	None	Ps 1
"	"	"	Salt crusty(1-2)	C (SiC)	C	(Gley spot)	Ps 2
"	"	"	"	SiL, SiCL (C)	C (SiCL)	Fe or Mn	Ps 3
"	"	"	Puffy (2-6)	SiCL (C)	SiL (C)	Fe or Mn	Ps 4
"	"	"	"	C (SiC)	C	(Fe + Mn)	Ps 5
Manzala	1.2-2.0	120-150	Puffy (3-10)	L, SiC	SiL, SiCL	(Fe or Mn)	Ma 1
"	2.0-3.0	"	"	C + SiL	C + SiL	(Mn)	Ma 2
	> 3.0	> 150	Puffy (6-20)	SiL, SiCL	SiL, SiCL	(Mn)	Ma 3

Notes: In texture, + and ( ) show frequent complex and inclusion of different horizons, respectively. In mottlings, ( ) does not mean every time appearance of them.

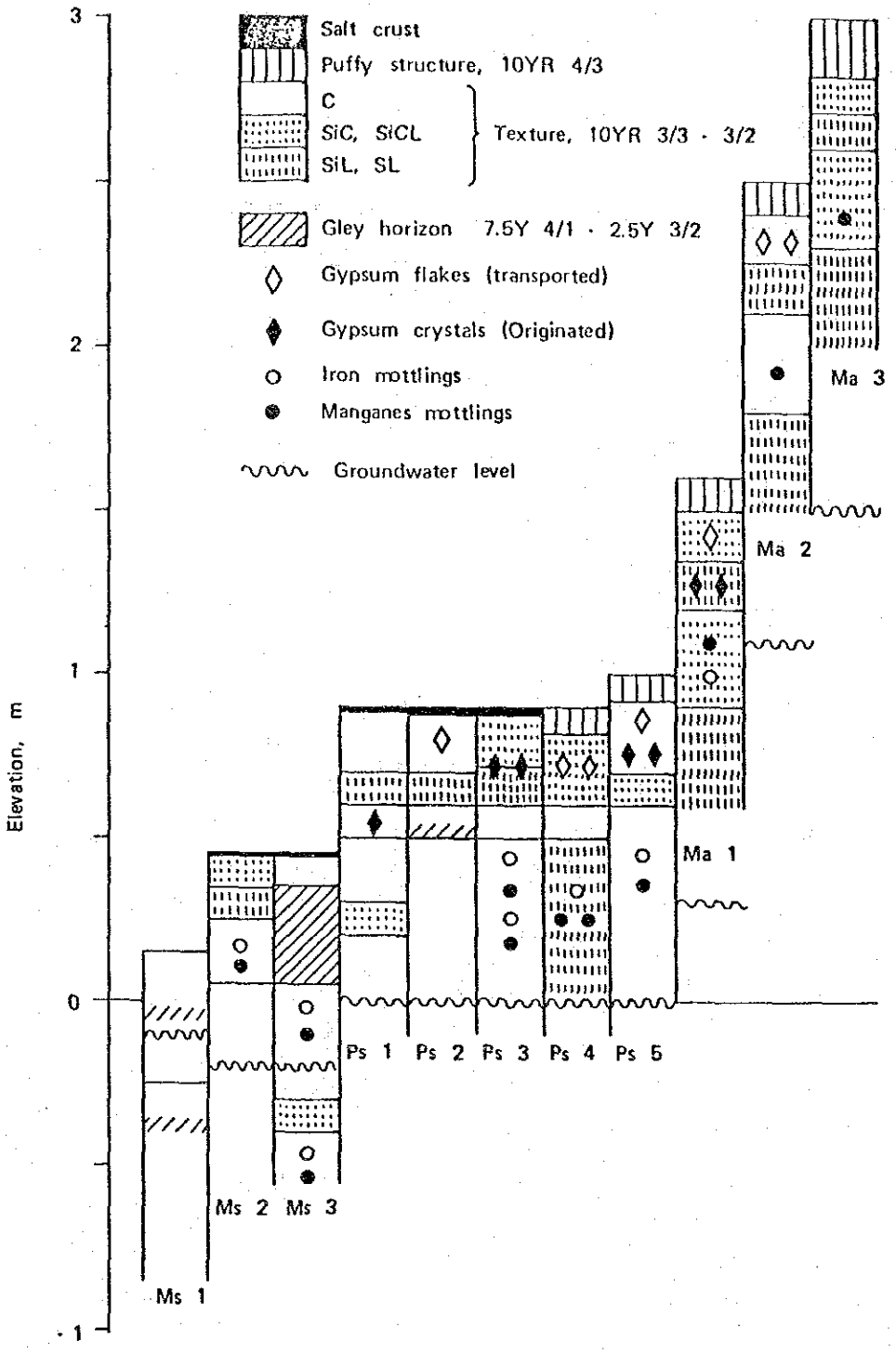


Fig. III-3 Profile Diagram of Soil Types

Table III-3 Distribution of Area by Soil Types

Soil Series	Soil Type	Distribution (No. of area)	Area ha	Area Feddan	Area %
Clay Swamp	Ms 1	3	5,400	12,860	17.2
	Ms 2	7	1,490	3,200	4.7
	Ms 3	5	6,180	14,700	19.7
	Total	15	13,070	30,760	41.6
Port Said	Ps 1	13	4,980	12,180	15.9
	Ps 2	6	2,340	5,570	7.5
	Ps 3	9	2,640	6,280	8.4
	Ps 4	1	1,170	2,790	3.7
	Ps 5	2	1,400	3,330	4.5
	Total	31	12,530	30,150	40.0
Manzala	Ma 1	9	2,050	4,870	6.5
	Ma 2	9	3,090	7,350	9.8
	Ma 3	12	660	1,570	2.1
	Total	30	5,800	13,790	18.4
Grand Total		76	31,400	74,700	100

series but pH of the soil is in the highest range from 7.6 to 8.2

Soils of Ms 3 cover around half of the series, where fish culture is being carried out along the main Drains.

2) Port Said Series (Ps)

Soils of this series occupy areas of intermediate elevations from 0.8 to 1.2 m, amounting to just 40 percent of the Area. The features of the top soil are characteristic varying from thin salt crust (Ps 1) to medium or thick salt crust (Ps 2 and Ps 3) and thin to thick puffy structure (Ps 4 and Ps 5). Texture of upper soil is clayey (Ps 1, Ps 2 and Ps 5) or silt loam to silty clay loam (Ps 3 and Ps 4). Weak to strong blocky or platy structure with common gypsum crystals and few oxidized iron or manganese mottlings (Ps 3 and Ps 4) or gley spots (Ps 2); hardness 10-20. Salt accumulation also deviates from 3.5 (Ps 3) to 115 mmhos (Ps 2, Ps 4 and Ps 5), being at highest level among series. Therefore, pH of the soil is as low as 7.0 - 7.6.

Areas of Ps 1 dominate among these Types, occupying 16 percent of the Area and adjoining to those of Ms Series.

3) Manzala Series (Ma)

Soils of this series lie at the highest elevation within the Area, including medium to high clay dunes and hummocks more than two meters high around ancient Tells. The upper 5 to 15 cm (Ma 3) soils display usually a thick puffy structure in which abundant needle crystals of NaCl are mixed with coarse soil aggregates. Surface as well as subsoil is rather coarse-textured, silt loamy (Ma 1 and Ma 3) and clayey (Ma 2). Moderate to strong blocky structure with a few manganese mottlings; hardness 10-23. Salt contents are also higher from 30 (Ma 3) to 120 mmohs (Ma 1). PH ranges from 7.4 to 8.0.

Areas occupied by this series are 18 percent out of which Ma 1 covers only two percent of the Area. Descriptions of the representative soil profiles are arranged in Appendix C-1 in the other volume.

III-2-5. Land Classification

In order to reclaim the land and improve the soils sciertifically as well as economically, the soils of each soil type were evaluated by Land Class (soil potentiality) in two ways; for land reclamation and for soil productivity.

In land classification for land reclamation, the following items were adopted with their potential criteria:

1) Drainage ---------- Depth of groundwater
2) Irrigation -------- Land elevation
3) Permeability ------ Structure and Texture
4) Desalinization ---- Salt content of soil
(expressed as EC of the saturation extract)

Class I and II (very suitable and suitable for irrigated agriculture) were not found in the Area.

Class III as subdivided to A, B and C, which are medium suitable but have valiant limitations in soil management, covered almost all of the soil types. Only soils of Ma 3 were ranked at Class IV A, which are preferably to be left for public use other than for agriculture because of their high elevation and historical character (ancient ruins). Class and areal distribution are shown in Table III-4.

Another land classification for soil productivity attempts to evaluate easiness in soil management and potentiality in fertility supposing the soil condition after land is reclaimed and facilitated in farming with irrigation system. Items for evaluation are cited as follows:

1) Workability -------- Stickiness and Hardness
2) Fertility ---------- Cation Exchange Capacity (CEC), and
Soluble nitrogen and phosphorus
3) Sodium removal ----- Ca^{++} / Na^{+} ratio (%) in me in the
saturation extract

Table III-4 Land Classes of Soil Types for Land Reclamation and Their Distribution by Areas

Class	Sub-Class	Suitability	Soil Type	ha	feddan	%
I		Very suitable	-	-	-	-
II		Suitable	-	-	-	-
III		Medium suitable				
	A	Slight soil management limitations	Ms 3, Ps 1, Ps 3	13,800	33,160	43.9
	B	Moderate management limi.	Ms 1, Ms 2, Ps 2, Ps 5, Ma 1	12,680	29,830	40.4
	C	Severe management limi.	Ps 4, Ma 2	4,260	10,140	13.6
IV		Suitable only under special conditions				
	A	Management limitations	Ma 3	660	1,570	2.1
	B	Reclamation limitations	-	-	-	-
V		To be determined after further detailed studies	-	-	-	-
Total				31,400	74,700	100

The results are summarized in Table III-5 in which about 60 percent of the Area belong to Class III A.

Map C-3 and C-4 attached in other Volume, showing land classes of soil types were separately provided at a scale of 1:50,000.

Discussions and recommendations are described for the pressing need in salt removal from the soil since accumulation of salt ranges from 300 to 1,800 tons per ha within one meter depth of the profile depending on the soil types. According to chemical analysis and extraction test of the soil samples, there were two groups found in releasing salts upon leaching. In one group soils which are less saline, salts become fast soluble and pH of the soil suspension tends to increase up to more than 9.5 being accompanied by clay dispersion. In the other group soils of high salinity, pH is difficult to exceed 8.5 as well as clay dispersion is very slower.

As a result it was suggested that depth of water for leaching the salts would be used at a rate of five volumes to the soil so that EC of soil water could decrease to around 4 mmhos which is considered critical to the better growth of salt-tolerant crops.

There was also need for continued studies pointed out on some problems of shallow leaching method, behaviour of gypsum contained in the soil and so on. Annex C can be referred to on the series of data and discussions.

Anyhow, differences among subclasses in class III seem not so significant except for those in salinity and depth of groundwater. Therefore if irrigation and drainage can be facilitated sufficient enough to remove the latter limitations, almost all lands would have a fairly good avability with expected better managements for the soil and crop culture in the Project Area.

Table III-5 Land Classes of Soil Types for Soil Productivity and Their Distribution by Areas

Class	Sub-Class	Suitability	Soil Type	ha	feddan	%
I		Very suitable	-	-	-	-
II		Suitable.	-	-	-	-
III		Medium suitable				
	A	Slight soil management limitations	Ms 2, Ms 3, Ps 1, Ps 3, Ma 2	18,380	43,710	58.5
	B	Moderate management limi.	Ma 1	2,050	4,870	6.5
	C	Severe management limi.	Ms 1, Ps 2, Ps 4, Ps 5	10,310	24,550	32.9
IV		Suitable only under special conditions				
	A	Management limitations	Ma 3	660	1,570	2.1
	B	Reclamation limitations	-	-	-	-
V		To be determined after further detailed studies	-	-	-	-
Total				31,400	74,700	100

III-3. Agriculture

The major summer crops in the Sharkia Governorate where the Project Area locates are cotton, paddy and maize. On the other hand, berseem and wheat are the main winter crops in this area. The total cultivation area of those five kinds of crops grown in the three-year rotational cropping system covered more than 80 percent of the total cropping area with the cropping intensity of about 190 percent.

In general, only paddy and berseem are cultivated as so-called "initial reclamation crops" for a few years after leaching has been completed in any newly reclaimed areas adjacent to the Project Area. After this initial reclamation period, only salt-tolerant crops such as cotton, maize, wheat and etc. are cultivated for some ten years depending upon the situation. After this final stage of reclamation period, relatively salt-sensitive crops together with vegetables are grown according to salinity concent ration after leaching to some extent in those areas.

III-3-1. Present Farming Practices

Fig. III-4 shows the typical cultivation schedule for major crops in the Delta area. In accordance with the cropping schedule, some of the crops are cultivated as follows in this area:

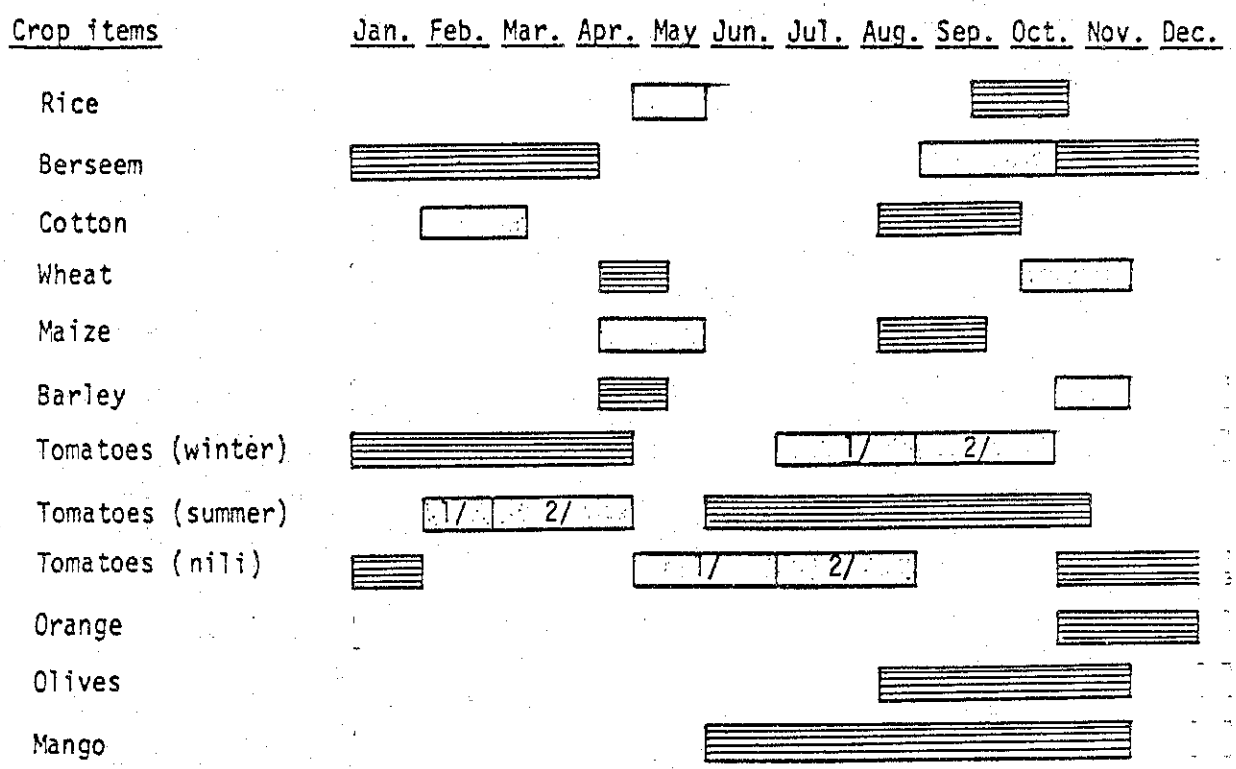
i) Paddy

In San El Hagar, the paddy is grown by the direct seeding method for the first few years of initial reclamation period in newly reclaimed areas. After this period, paddy seeds are sown in seedbeds around May and one month old seedlings are transplanted to paddy fields. The paddy is havested by man-power from middle of September to October. The cropping period is about 150 days. The spacies of the paddy in this country is the improvement spacies of Japonica.

ii) Berseem

In San El Hagar, seeds of berseem are sown during the period of September 15 through October 15. If cultivated in paddy fields, they are sown when the paddy are still standing in the fields. Full-terms berseem which is cropping up to middle of April, provides four cuttings and catch-cropping berseem two cuttings.

Fig. III-4 Present Cropping Pattern in Delta Area



Data Source: Ministry of Land Reclamation

iii) Cotton

Cotton seeds are sown on ridges during February to March. Several seeds are sown at one place. After 40 days, the cotton are thinned, when the first nitrogenous fertilization is done as a top-dressing fertilization. Cotton is harvested by man-power between August and September. Children and women can be employed during this period.

iv) Wheat

Seeds are scattered in the fields in October to November. Nitrogenous fertilizers are applied when they are about 40 days old. Usually, no phosphoric fertilizers are applied. Wheat is harvested by man-power from April to May.

v) Maize

Seeds are sown on ridges around the first of May. The first nitrogenous fertilization is done when the plants are about 40 days old. And then after two weeks, the second one is done. No phosphoric fertilizers are applied. The harvesting works is done by man-power from August to September.

III-3-2. Farm In-put Materials

The maximum amount of fertilizers to be applied to unit area is fixed every year by the Government. The appropriate quantity of seeds to be sown per feddan for major crops is also presented by the Government. The actual amount of seeds sown by farmers is close to this amount.

Incidentally, Table III-6 show the maximum fertilization levels for major crops determined by the Government in 1980 and the appropriate seeding levels recommended by the Government respectively.

III-3-3. Agricultural Production

The Sharkia governorate is one of the most important cereals-producing areas in Egypt. The annual cropping area of each of the so-called "Egyptian five major crops" such as cotton, paddy, berseem, maize and when in the

Table III-6 Maximum Fertilization and Seedling Level (1980)

(unit;Kg/feddan)

Crop	Calcium uitrate 2/4/	Super-phosphate 3/4/	Seed 5/
Rice	200	100	60
Cotton	350	100	60
Wheat	325	50	75
Berseem	-	100	25
Maize	400	-	20
Barley	300	-	60
Tomato	600	150	
Potato	600	150	
Sesame	200 1/	100	2
Groundnuts	100 1/	100	40
Beans	50	150	60
Lentils	50	100	20
Fenugreek	50	100	
Lupine	50	100	35
Flax	300	100	65
Alfalfa	50	300	10
Most of vegetables	300	-	

Note; 1/ Level fixed especially for the Sharkia Governorate

2/ N: 15.5% 3/P_2O_5: 15%

Source; 4/ The Principal Bank for Development and Agricalutural Credit

5/ Ministry of Land Reclamation

governorate has been somewhere between 10% and 17% of the total national cropped area respectively over the past five years.

The average yield of the most of the vegetables in the Sharkia governorate has been about the same as or more than the national average.

The Sharkia governorate is a very important producer of fruits such as mangoes, citrus and dates in Egypt. However, only the sandy areas are considered to be suitable for the cultivation of fruits in the governorate.

Incidentally, Table III-7 and Table III-8 show the average yield and the total production of some main crops in the Sharkia governorate where the Project Area locates.

III-3-4. Livestock Production

It is estimated that more than 70% of the cows in Egypt are owned by small farmers to be utilized for farming and production of milk and meat. In rural areas close to large cities, some buffaloes are kept by small private groups for milk-production purposes. It is reported that the number of cows and buffaloes in the Sharkia governorate was approximately 180,000 and 170,000 respectively in 1978. Incidentally, more than 60% of all working time of draft animals in Egypt is presently spent on irrigation works associated with "Sakkia".

III-3-5. Prices of Agricultural Products

The minimum target production of some of the main crops in each district is fixed by the Government according to the land fertility levels. However, farmers are allowed to sell any surpluses of their products onto the private market after putting the quotas for the agricultural products controlled by the Government through the governmental distribution system. Table III-9 shows the governmental purchasing price of some main crops.

Table III-7 Yeild of Major Crops
(In Sharkia Governorate)

(Unit: tons/feddan)

Crop	1975	1976	1977	1978	1979
Rice	2.336	2.044	2.067	2.252	2.448
Wheat	1.586	1.485	1.485	1.467	1.338
Barley	1.292	1.330	1.298	1.291	1.266
Fenugreek	0.570	0.563	0.556	0.575	0.583
Beans	1.052	0.930	0.942	0.977	0.938
Lentils	0.600	0.560	0.528	0.584	0.554
Cotton (seed)	0.665	0.636	0.665	0.814	0.925
Groundnuts	0.827	0.852	0.838	0.854	0.874
Sesame	0.239	0.239	0.439	0.263	0.283
Maize 1)	1.649	1.518	1.518	1.737	1.761
Maize 2)	1.348	1.345	1.296	1.187	1.198
Lupine	0.629	0.606	0.609	0.624	0.615
Potato	7.600	8.390	8.080	7.740	8.600
Tomato 1)	6.999	7.381	7.084	8.932	9.142

Notes: 1) Summer cropping 2) Nili cropping

Source: Department of Statistics, Ministry of Agriculture

Table III-8 Production of Major Crops
(In Sharkia Governorate)

(Unit: tons)

Crop	1975	1976	1977	1978	1979
Rice	408,773	374,350	331,539	349,461	389,291
Wheat	257,983	257,256	209,890	239,409	226,114
Barley	16,060	18,758	17,359	17,753	17,637
Fenugreek	634	575	461	287	326
Beans	26,126	26,784	25,482	17,668	16,384
Lentils	4	2	3	75	15
Cotton (seed)	91,647	84,081	107,110	116,380	126,762
Groundnuts	5,464	5,792	6,814	5,063	4,520
Sesame	42	33	1,031	31	61
Maize 1)	340,716	309,713	279,043	346,274	361,118
Maize 2)	45,676	34,988	47,422	49,513	51,462
Lupine	2,157	1,662	1,718	1,047	823
Potato	4,250	6,400	10,415	10,633	17,775
Tomato 1)	132,698	145,295	127,665	163,200	169,544

Notes: 1) Summer cropping 2) Nili cropping

Source: Department of Statistics, Ministry of Agriculture

Table III-9 Governmental Purchasing Price of Major Agricultural Products

Product Items	1974	1975	1976	1977	1978	1979	1980
Rice 1/	32.00	40.00	50.00	50.00	65.00	65.00	-
Wheat (Indian Varieties) 2/	6.25	7.00	7.00	7.00	7.00	9.50	11.50
Wheat (Mexican Varieties) 2/	6.50	8.00	8.00	8.00	8.00	10.50	12.50
Beans 2/	9.00	13.00	13.00	15.00	15.00	20.00	25.00
Lentils 2/	17.00	17.00	22.00	22.00	22.00	35.00	40.00
Sesame 2/	19.00	22.00	25.00	25.00	25.00	50.00	65.00
Sugarcane 3/	6.00	7.00	8.00	8.00	9.00	9.50	12.50
Groundnuts 2/	7.50	10.00	11.00	11.00	18.00	18.00	-
Onion 1/	22.00	27.00	33.00	38.00	38.00	43.00	-
Seed Cotton 3/	-	23.92	33.36	35.74	36.24	48.45	-

Data Source: Department of Statistics, Ministry of Agriculture

Notes: 1/ Price : L.E./ton
2/ Price : L.E./ardeb
3/ Price : L.E./kantar

III-3-6. Prices of Farm In-put Materials

The Government has been distributing necessary agricultural input materials among farmers through such public bodies as local agricultural cooperatives, regional branch organizations of the Principal Bank for Development and Agricultural Credit.

The prices of input materials such as fertilizers, seeds, pesticides, etc. distributed through the public bodies are fixed by the Government depending upon the subsidizing policies and strategies from time to time.

III-3-7. Land Tenure System

The average area of each of the villages numbering about 4,000 in Egypt is approximately 15,000 feddans. Since the average number of farm households in each village is estimated at 500, the average cultivation area per farm households is approximately three feddans.

Some of the farmers hold the ownership of their own cultivation lands and the rest of them rent their lands from the Government or large-scale land owners.

III-3-8. Farm Mechanization

It is estimated that the average annual cultivation area covered with one unit of tractor, pump and thresher is roughly 400 feddans, 500 feddans and 800 feddans respectively in Egypt.

There are three types of machinery farming operation services available to small farmers as follows:

i) Group operation services

More than 50% of all of the tractors in Egypt are privately owned by groups of small farmers. Machinery operation services offered by these group members are available. To farmers who do not belong to the groups, reasonable operation charges (3 LE/hr. unit) could be applied.

ii) Cooperative operation services

It is reported that machinery farming operations for less than 10% of the total annual cropping area are done by utilizing the machinery services offered by cooperatives. Cooperative machinery operation charges (1.3 to 2 LE/hr. unit) are less than the actual costs (6 to 6.4 EL/hr unit), since they are subsidized by the Government.

iii) Governmental operation services

An autonomous governmental organization has been providing machinery farming operation services in order to facilitate the implementation of the existing governmental soil amerioration projects. Machinery service charges (2 LE/hr. unit) are less than the actual costs (4.6 LE/hr. unit), since they are subsidized by the Government.

III-3-9. Research

The Agricultural Research Center administered by the Ministry of Agriculture has been responsible for all types of governmental agricultural research activities since 1971.

Well-organized research programmes launched by each institute which belongs to the center have released new high yielding varieties of cotton, paddy, wheat, maize, etc. adapted to the local agronomic conditions of Egypt.

III-3-10. Extension Services

Governmental bodies involved in agricultural extension organization in Egypt are well organized at both central governmental and local governmental levels. In each village, four ha of field-plots with good irrigation and drainage system are utilized as demonstrational plots for extension purposes. In addition to the extension services organized by the Ministry of Agriculture, the Ministry of Land Reclamation is also responsible for providing new settlers with extension services in newly reclaimed areas.

III-4. Agricultural Infrastructures

III-4-1. Irrigation Condition

There are existing farm lands of 6,000 feddans (about 2,500 ha) in the Project Area. All of these farm lands have been artificially irrigated because, in general, sufficient rainfall can not be expected in this country belonging to the arid zone countries. These farm lands are distributed along the drains for relatively easy intake of irrigation water therefrom; that is, they are roughly divided into two groups, one, consisting of 4,000 feddans (about 1,700 ha) of the farm lands, is located along the Bahr Saft drain on the western border of the Project Area and the other, consisting of two farming complexes covering 2,000 feddans (about 800 ha) along the existing canal on the southern border of the Project Area. The low-lying lands extending along the Ramses drain have not been reclaimed into farm lands due to being submergible areas.

The farm lands along the Bahr Saft drain, which were reclaimed by individual farmers more than 15 years ago, have been developed on the right bank of the drain with areal width ranging from 0.5 to 1.0 km, and some of these lands have come to provide the farming conditions at the similar level to those existing farm lands around the Project Area. These farm lands are cropped with paddy, cotton and maize in the summer season, while wheat, vegetables and berseem (egyptian clover) in the winter season.

The irrigation water source for these lands is the Bahr Saft drain, from which the water is taken by gravity system into the irrigation canals provided in the fields and conveyed to the plots through the terminal facilities after being lifted by small-size pumps called "Sakkia" which are operated by draft animals.

The irrigation water source for these lands, which has some problems in its quality due to originating in the drain, has been under the independent operation and maintenance of the related farmers.

The existing reclaimed lands extending along the southern border of the Project Area is dependent in its water supply upon the return flow

from the upstream area outside the Project Area. These lands, having no exclusively dependable water sources, urgently require to secure a stable water source in both quality and quantity.

III-4-2. Drainage Condition

The drainage conditions in the Project Area are extremely unfavourable, and 29,000 feddans (about 12,200 ha) out of the total Project Area of 74,700 feddans (about 31,400 ha), which are equivalent to about 40 percent of the total, are submerged areas. Such a large-scaled submergence has been caused from absence of dykes to shut out the water of the Manzala lake which fluctuates in the water level in a range from WL 0.0 to 0.5 m against the elevation of submerged areas below EL 0.25 to 0.5 m. Besides, the submerged areas, extending very flat, vary in acreage from fluctuation of the water level in the Lake.

Judging from the water traces observed around the submerged areas, the water level appears to rise up to WL 0.5 m while the minimum water level is estimated at WL 0.0 m. The water intrusion from the Manzala lake will be completely intercepted by the embankment of the El Salam Canal that is now under construction by the Ministry of Irrigation. Therefore, the present submerged areas will naturally be dried up when the said embankment is completed.

The hilly lands (cultivable waste lands) developing from south to west in the Project Area provide several depressions below EL 0.25 m, into which highly concentrated salty groundwater (about 30% of salinity concentration) has been flowing from the peripheral areas. However, no outlets with them but a large annual evaporation in the area have turned them into salty lakes with accumulation of chrysterized salt.

The newly reclaimed lands around the Area are drained by pumps, which can well control the groundwater table so as to prevent the soils from salt accumulation caused by high groundwater. The water level of these drainage canals is kept about one meter below ground surface at the terminal field drains.

III-4-3. Road Condition

There are no community roads nor farm roads in the Project Area. Only paths traced by tractors transporting the salts gathered from the lakes are found therearound. These paths, having about two to three meters width to allow a tractor to pass, have been affected by wind and rain to change in their courses from year to year. However, the paths are only available by two or three route running from south to north but not from east to west. Under the circumstances, it is almost impossible to access to the area by vehicle. In particular, there have been no human foot traces found in the submerged area due to total absence of roads, even tractor paths.

Around the Project Area, there is an operation and maintenance road running along the Bahr Baqar, the eastern border of the Area, but this is an earth paved road with four to five meters width an appears to be inadequately maintained.

Along the Bahr Saft drain, the western border of the Area, a two to three meters wide earth paved road is partly running but the maintenance services seem to be poorly rendered. Furthermore, no bridges nor any crossing structures over this drain are found excepting for ferry services available at several points for men, animals and light carts.

The roads running in the peripheral area of the Project Area, although all paved with asphalt, have rough surfaces resulting from poor maintenance works. The total width is about eight to ten meters, including passable width of six to eight meters.

III-4-4. Field Conditions

The Project Area is mostly covered with soil desert excepting some existing farm lands, providing no particular on-farm facilities to prevent the Area from development. The Project Area is surrounded by the developed farm lands, the fields of which have been intensively land-consolidated with land levelling. The respective field plots are of rectangle with the length of run of 150 - 200 meters and width of about 100 meters, and the

irrigation canals are provided in complete separation from the drainage canals.

All of the canals are earth-lined and the tertiary canals, having the width of three to four meters, keep the water level 0.5 to 1 meter below the field surface. The water supply from canals to the fields has been made by Sakkia or portable pumps. The surface irrigation is dominant in these farm lands and no sprinkler irrigation nor drip irrigation has been observed. In the fields, farm drains have been provided at about 20 meters interval so as carry out leaching for salt elimination. Farm roads with about four meters width run along the tertiary canals.

CHAPTER IV THE PROJECT

CHAPTER IV. THE PROJECT

IV-1. Objectives of the Project

A greater part of the Project Area is covered with soil desert except for existing farm lands of about 6,000 feddans (about 2,500 ha). The Government of Egypt has commenced the El Salam Canal Project so as to increase the agricultural production through converting such desert land into farm fields. And the construction of the El Salam Canal, on the other hand, has ensured to maintain the water resources for irrigation to the Project Area. Under the situation, the agricultural development program in the Project Area is considered promising with provision of a variety of such facilities essential for agricultural production as irrigation/drainage canals, roads, on-farm facilities, etc. since those conditions of soils, climate, topography, etc. are favourable to farmings.

The objectives of the Project are to expand the farming fields, increase the agricultural production, and provide larger labour opportunities with the inhabitants in the Project Area and its vicinity by land reclamation and to conserve the living environment for the rural area by providing irrigation/drainage facilities, roads as well as by securing domestic water and electric power supply. Achievement of these objectives to have quick target-yield from the Project will require to promote the following matters to cope with execution of the Project works.

i) Construction of irrigation/drainage facilities together with securing the water resources to meet the requirements of agricultural development plan based on the proposed land use and cropping pattern.

ii) Land reclamation including land consolidation to cope with irrigated agriculture and modern farm management.

iii) Provision of road networks for transporting farm inputs/outputs.

iv) Plan formulation for farmers' organization and agricultural extension services.

v) Construction of facilities necessary for animal husbandry development to meet the proposed cropping pattern.

vi) Plan formulation for rural development.

IV-2. Project Components

1) Agricultural Development Plan

i) Irrigated agriculture: to introduce new farming technique with successful water management.

ii) Animal husbandry: to construct necessary livestock facilities according to the proposed cropping pattern and land use.

iii) Farmers' organization: to establish organizations for successful water management and operation & maintenance of facilities.

2) Construction Plan

i) Irrigation/Drainage canals: to construct main/secondary canals for irrigation/drainage.

ii) On-farm development: to construct on-farm facilities including land levelling, farm ditch/drain and on-farm road.

iii) Road networks: to construct trunk roads and farm roads including O & M roads.

3) Rural Development Plan: to fomulate the plan of rural facilities within villages. (The construction cost is not including to the Project Cost)

Implementation of the above works will require to procure the necessary equipment and materials for the construction works and provide the engineering services to be rendered by consultants for successful achievement of the Project.

IV-3. Agricultural Development Plan

IV-3-1. Proposed Land Use

The conditions of the present land utilization in the Project Area and the future land utilization with the Project are shown in Table IV-1. With respect to agricultural land utilization, it would be concluded that there will be no significant differences among classified agricultural lands in terms of their crop productivity.

Thus, no field plots will be specialized for any particular crop according to the agronomic land nature and properties as clarified in the land classification system.

With respect to the actual utilization of the non-arable waste lands with the total area of about 1,400 feddans (about 600 ha), they will be utilized as multi-purpose sites for livestock centers.

IV-3-2. Agricultural Production

1) Crop Selection for Cropping Pattern

It is conceived that the local climatic conditions would hardly control and limit the selection of agronomic crops, except for some special type of crops, to be introduced to the Project Area. Whereas, the soils are very saline due to impeded drainage and the high table of groundwater with extremely high salinity. However, it is not necessary that crops to be introduced in the Area are limited as special tolerant crops, when leaching operations were enough to be done. Although the salinity (800 PPM) of the irrigation water with the Project would not be hazardous to the normal growth of crops, there is a great deal of possibility that the continuous irrigation will accumulate salts in the soils without leaching.

In this connection, although leaching operations are to be done, introduction of salt tolerant crops or varieties in the Project Area will be the most fundamental agronomic strategy for the crop production scheme.

Table IV-1. Proposed Land Use

(Unit: feddan)

Item	Present		Proposed	
	(feddan)	(ha)	(feddan)	(ha)
1. Net cultivation area	6,000	2,500	49,700	20,900
2. Submerged area	29,000	12,200	-	-
3. Arable area not in use	39,300	16,500	-	-
4. Others 1/	400	200	25,000	10,500
Total	74,700	31,400	74,700	31,400

Note: 1/ Details are as below

Item	Area	
	(feddan)	(ha)
Existing roads & canals	500	200
Non-arable waste lands	1,400	600
Residence area	2,400	1,000
Planned roads & canals	6,700	2,800
Terminal facility-sites	14,000	5,900
Total	25,000	10,500

Incidentally, the Five-Year Plan has placed special emphasis on the expansion of staple field crop production to maintain its self-sufficienty in foodstuffs and also on the production expansion of livestock produce such as beef meat.

Taking into consideration the above-mentioned factors associated with successful production of crops in the Project Area, paddy, berseem, cotton, wheat, maize and soiling corn have been selected for the establishment of the proposed cropping pattern.

2) Proposed Cropping Pattern

Fig. IV-1 shows the proposed cropping pattern in which only paddy and berseem are intensively grown during the first three years after leaching operations have been done.

After this period, other salt-tolerant crops such as cotton, wheat and maize are also grown in the 3-year rotation system as shown in Fig. IV-2. Basically, in this 3-year rotation system, the whole cultivation area will be divided into three blocks and each block will be planted to cotton, paddy or maize respectively as a summer crop.

3) Cultivation Practices

i) Paddy

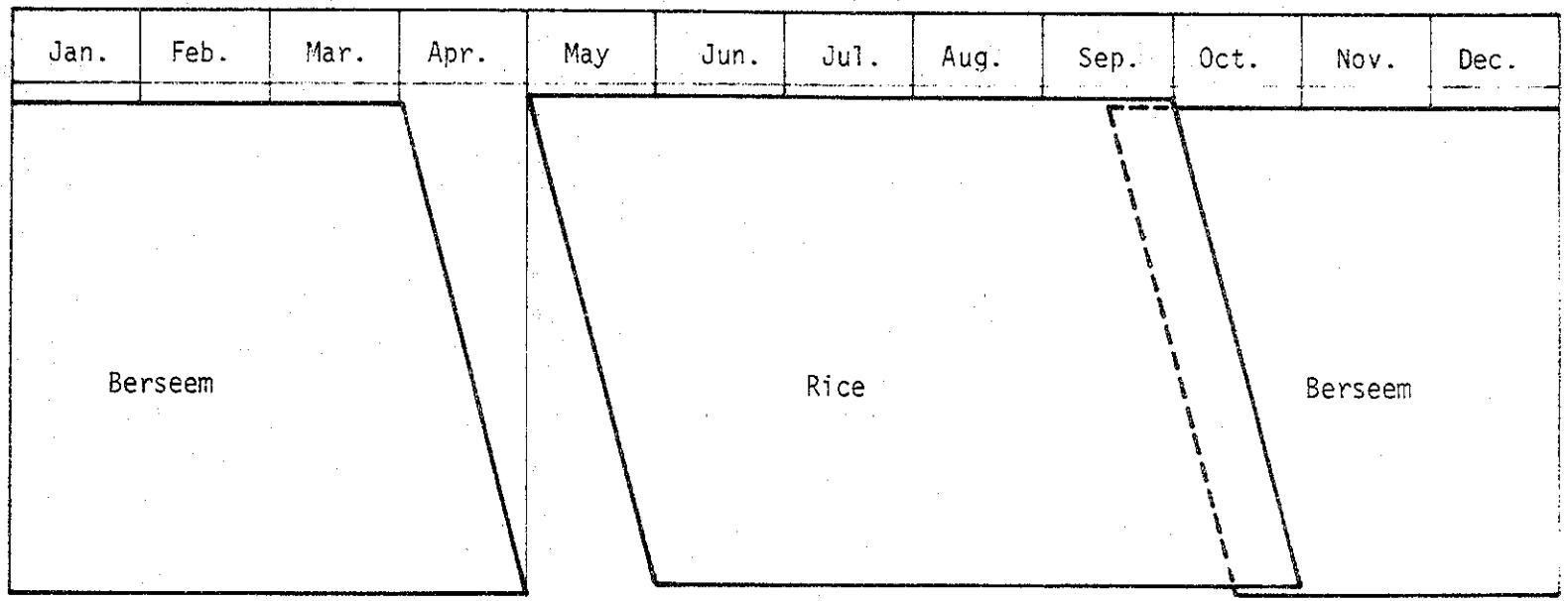
Paddy will be grown by "the direct seeding cultivation method" for the first three years in the initial reclamation period. After this period, however, paddy will be grown by "the transplanting cultivation method" in the 3-year rotation system.

ii) Berseem

The seeds of full-term berseem will be scattered among the paddy plants and no field preparation works will be required.

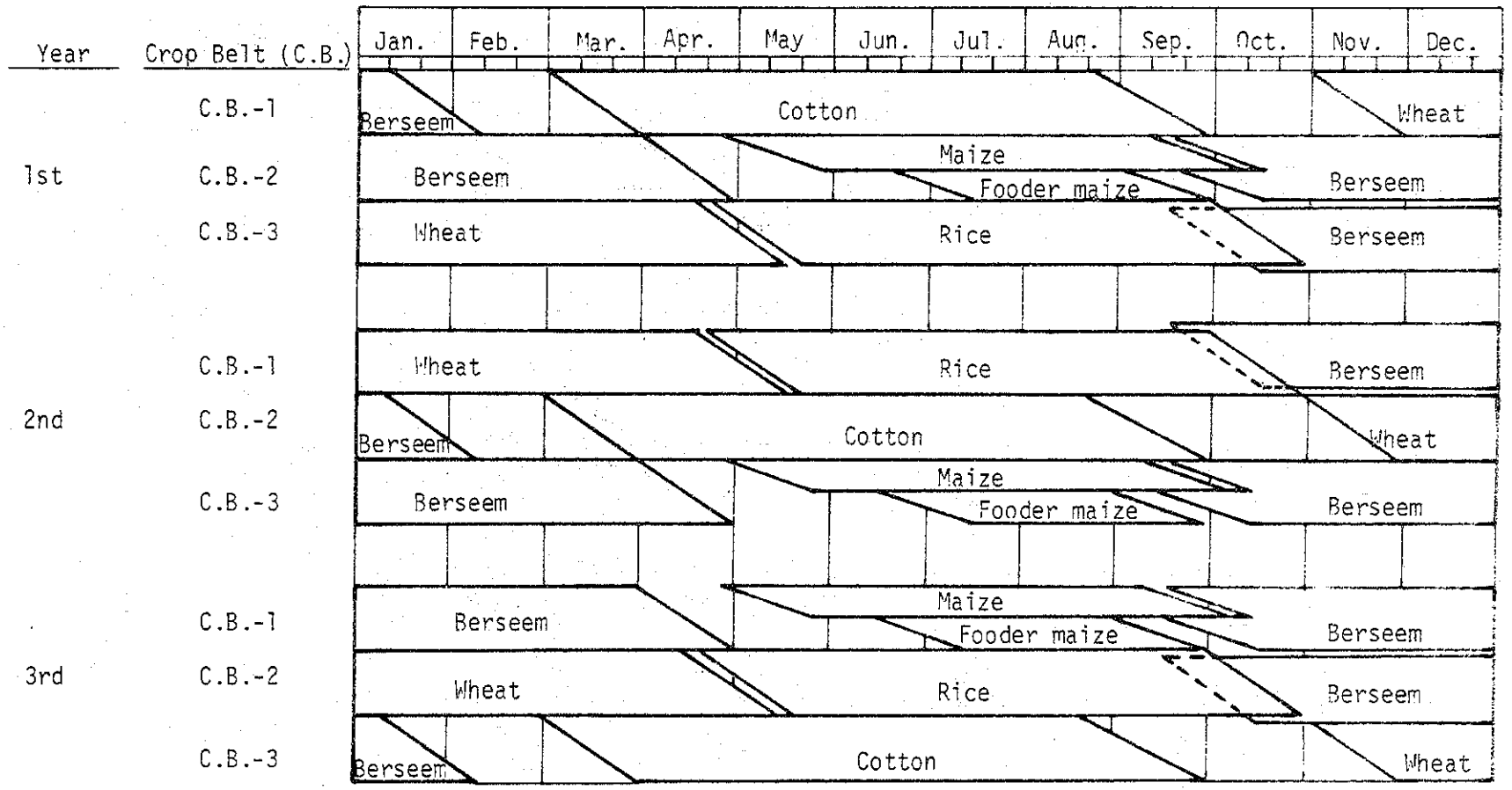
The first fertilization will be done approximately one month after seeding. Next top dressing fertilizers will be applied at the time of the first and the second harvesting.

Fig. IV-1 Cropping Pattern of Initial Reclamation Period[1/]



Note: 1/ The cropping pattern for the first 3 years after leaching has been completed. After this period, the 3-year rotation system will be initiated.

Fig. IV-2. Proposed Cropping Pattern[1/]



Note: 1/ Started upon the termination of initial reclamation croppin period.

iii) Cotton

Seeds of cotton will be sown on ridges by a seeder equipped with a ridger.

Although 240 kg of superphosphate per ha is applied as a basic fertilizer, 180 kg of urea per ha will be top-dressed two times after thinning of plants has been done.

iv) Wheat

Seeds of wheat will be scattered in the fields by broadcasters.

260 kg of urea per ha will be applied about 40 days after seeding and no phosphorus fertilizers will be applied as a local farming practice.

v) Maize and soiling corn

Seeds of maize will be sown on ridges by a seeder equipped with a ridger. 240 kg of urea per ha will be top-dressed two times after thinning of plants has been done. No phosphorus fertilizers will be applied as a local farming practice.

4) Target Yield

The target yield of the six kinds of crops involved in the cropping pattern are determined based on the yield of the experimental farm and the surrounding area of the Area as follows:

i) Paddy

In the first year, the yield will be as low as 1.2 tons/ha. It will be increasing by two times in the second year and attaining the proposed target yield of 7.1 tons/ha in the sixth year.

ii) Berseem

The proposed target yield of 57 tons/ha will be attained in the sixth year for the cultivation of full-term berseem which provides four cuttings. It will be 28.5 tons/ha for the cultivation of catch-cropping berseem with two cuttings. However, in the first year, it will be as low as 33% of the proposed target yields.

iii) Cotton

The proposed target yield of seed cotton, 3.0 tons/ha will be attained in the fourth year. It will be less than 1 ton/ha in the first year and gradually increased until the fourth year.

iv) Wheat

The proposed target yield of wheat will be 4.3 tons/ha. It will be about half as much in the first year.

v) Maize

The proposed target yield of maize will be 5.3 tons/ha. It will be as low as 2.7 tons/ha in the first year. It will increase by some one ton/ha annually until the fourth year.

vi) Soiling corn

The proposed target yield of soiling corn will be 60 tons/ha. It will be half as much in the first year.

5) Utilization of Agricultural By-products from the Project

Rice straws as agricultural by-products from the Project will be fed to beef cattle in the Project Area. Consequently, their value will be evaluated in terms of the value of beef cattle produced. Other agricultural by-products will be also utilized as roug-ages and fuel depending upon the situation by individual farmers.

6) Proposed Agricultural Production and Incremental

The proposed target production of each crop will be expected in the 12th through the 14th year in the project life. The proposed production is summaried as follows.

Proposed Production

(Unit: 1,000 tons)

Crop	Production
Rice	49
Cotton	21
Maize	19
Wheat	30
Soiling Corn	213
Berseem	600

After complation of the Project, the incremental production of paddy, cotton and wheat is 45,000, 20,000 and 29,000 tons, respectively. Other three crops is newly introduced in the Area. (Refer to Table IV-2, -3 and -4).

7) Livestock Production Plan

The shortage of beef meat has been conspicuous in Egypt as was the case in 1979 when 27,000 tons of poultry meat and 34,000 tons of beef meat had been imported.

Therefore, beef cattle should be the livestock item to be introduced into the Area.

i) The amount of feed available

The annual production of 835,000 tons of roughages to be fed to the beef cattle with the Project is shown in Table IV-5. Approximately 125,000 tons of Total Digestible Nutrients (TDN) will be available per year.

ii) Unit feed requirements

The unit feed requirements for each herd with 100 head of cattle are shown in Table IV-6. Approximately 140 tons of total digestible nurtrients (TDN) will be required for each herd per year.

Table IV-2 Proposed Production of Cereals

(Unit: tons)

Year	Rice	Cotton	Maize	Wheat
1st	-	-	-	-
2nd	-	-	-	-
3rd	5,016	-	-	-
4th	15,048	-	-	-
5th	30,096	-	-	-
6th	38,372	1,241	1,919	-
7th	46,649	3,862	4,548	3,449
8th	51,427	7,449	7,888	8,138
9th	51,188	11,587	11,654	13,242
10th	45,934	15,725	15,420	19,174
11th	47,451	18,622	17,268	25,105
12th	48,969 1/	20,139	18,405	27,588
13th	48,969	20,691 1/	18,831 1/	28,829
14th	48,969	20,691	18,831	29,657 1/
15th	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
50th	48,969	20,691	18,831	29,657

Note: 1/ Proposed target production

Table IV-3 Production of Forage Crops

(Unit: ton)

Year	Season	Berseem			Green Fodder Maize
		Full-term	Catch-Cropping	Total	
3rd	Su[1/]				
	Wi[2/]	19,855	-	19,855	-
4th	Wi	59,565	-	59,565	-
	Su	-	-	-	-
	Wi	44,935	-	44,935	-
5th	Wi	134,805	-	134,805	-
	Su	-	-	-	-
	Wi	65,239	10,001	75,240	-
6th	Wi	195,718	10,001	205,719	-
	Su	-	-	-	21,318
	Wi	78,344	23,502	101,846	-
7th	Wi	235,031	23,502	258,533	-
	Su	-	-	-	50,453
	Wi	94,896	40,556	135,452	-
8th	Wi	234,690	40,556	325,246	-
	Su	-	-	-	87,404
	Wi	94,698	60,809	155,507	-
9th	Wi	284,094	60,809	344,903	-
	Su	-	-	-	130,040
	Wi	89,274	81,061	170,335	-
10th	Wi	267,823	81,061	348,884	-
	Su	-	-	-	172,676
	Wi	88,626	91,312	179,938	-
11th	Wi	265,800	91,312	357,192	-
	Su	-	-	-	193,994
	Wi	95,179	98,063	193,242	-
12th	Wi	285,535	98,063	193,242	-
	Su	-	-	-	207,495
	Wi	98,282	101,261	199,543[3/]	-
13th	Wi	294,847	101,261	396,108[3/]	-
	Su	-	-	-	213,180[3/]
	.	.	.	.	.
	.	.	.	.	.
	.	.	.	.	.

Note: 1/ Summer 2/ Winter 3/ Target production

Table IV-4 Proposed Cultivation Area

(Unit: ha)

Year	Season	Rice	Berseem	Cotton	Maize	Wheat	Total
3rd	Su 1/	4,180	-	-	-	-	4,180
	Wi 2/	-	4,180	-	-	-	4,180
4th	Su	8,360	-	-	-	-	8,360
	Wi	-	8,360	-	-	-	8,360
5th	Su	12,540	-	-	-	-	12,540
	Wi	-	12,540	-	-	-	12,540
6th	Su	13,920	-	1,380	1,420	-	16,720
	Wi	-	15,340	-	-	1,380	16,720
7th	Su	15,300	-	2,760	2,840	-	20,900
	Wi	-	18,140	-	-	2,760	20,900
8th	Su	12,500	-	4,140	4,260	-	20,900
	Wi	-	16,760	-	-	4,140	20,900
9th	Su	9,700	-	5,520	5,680	-	20,900
	Wi	-	15,380	-	-	5,520	20,900
10th	Su	6,900	-	6,900	7,100	-	20,900
	Wi	-	14,000	-	-	6,900	20,900
11th	Su	6,900	-	6,900	7,100	-	20,900
	Wi	-	14,000	-	-	6,900	20,900
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50th	Su	6,900	-	6,900	7,100	-	20,900
	Wi	-	14,000	-	-	6,900	20,900

Note: 1/ Su: Summer
2/ Wi: Winter

Table IV-5 Annual Production of Roughages

	Cropping Area(ha)	Yield per ha(ton/ha)	Yield (ton)	Nutrients*/ per Unit(%)	Production of Nutrients(ton)
Full-term berseem	6,897	57.0	393,129	13.1	51,500
Catch-cropping berseem	7,106	28.5	202,521	13.1	26,530
Rice straw			26,125	37.1	9,692
Green fodder maize	3,553		213,180	17.3	36,880
Total			834,955		124,602

Note: */ : Total digestible nutrients (TDN)

Table IV-6. Unit Feed Requirements per Herd

Growth Stage	Weight (kg)	Feed Requirement (TDN) (kg/head/day)	(kg/head/year)	Composition of Herd (head)	Feed Requirement (TDN) of the Herd of Cattle (ton/year)
Calf	120	2.0	730	30	22
Raising Cattle	270	3.8	1,387	30	42
Cattle	450	5.3	1,935	40	77
Total				100	141

iii) Number of beef cattle to be raised

Based on the total feed availability and unit feed requirements as the above, 88,400 head of beef cattle will be raised in the Project Area. Out of 88,400 head, 26,520 head of calves, 26,520 head of raising cattle and 35,360 head of grown-up cattle will be raised in the Area.

iv) Livestock facilities

Basically, non-arable waste lands will be utilized for the construction of the facilities in order to avoid any adverse effects on the full utilization of arable lands in the Project Area.

The cattle raising facilities will be located separately in the four livestock centers to be constructed in the non-arable lands to facilitate the prevention of public nuisance associated with livestock industry, protection of animal diseases, efficient transportation of feeding materials, etc.

Incidentally, one cattle group with 8,840 head of calves and the same number of raising cattle will be kept in each of the three livestock centers and the remaining livestock center will keep all of the grown-up cattle.

v) Operation and maintenance plan

a) Feed and water supply

Berseem as the main roughage needed for each livestock center will be purchased at the farm gate of farmers producing the crop in the Project Area.

The plan of drinking water supply for beef cattle has been incorporated into the domestic water supply plan in the Project Area. The plan has been made based on the unit drinking water requirement of 60 ℓ/day/head.

b) Management staff

Staff members needed for the management and maintenance of the cattle raising and futtening facilities at each livestock center will be as follows:

- Cattle management staff
  Approximately 600 workers will be needed for cattle management purposes.
- Special management staff
  Each center office will need two to three veterinarians as special management staff members.

c) Slaughter plan

A unit of slaughtering facilities will be installed in the Project Area. This plan will enable the Project Area to produce beef of about 8,000 tons/year.

IV-3-3. Agro-processing

Most of the agricultural produce as raw materials derived from the Project Area will be transported to other parts of the Country of exported to foreign countries. On the other hand, the rest of the produce as food materials consumed by settlers will need to be processed in the Project Area.

Of some food items, wheat and maize will be the most important food materials which are frequently consumed by the prospective settlers. For this reason, machinery to flour wheat and maize should be introduced into the Project Area.

Crops	Consumption (1,000 tons) Project Area	Other Area	Total
Rice	5	44	49
Cotton	-	21	21
Maize	8	11	19
Wheat	12	18	30
Meat	2	6	8

IV-3-4. Farm Management Plan

1) Demand and Supply of Farm Labors

The number of farmers available for settlement in the Project Area was estimated at 12,740 households. A typical farm family composition is assumed to have six members of a husband and wife, an aged member and three children, and when taking the farm labor forces available usually by the family head and an aged or children per family, the estimated workable forces are 1.5 persons per family. Thereby, the estimated workable forces are 19,000/day. On the other hand, in September, the busiest season of farming works, women and children will be mobilized for comparatively simple works like cotton plucking, etc. and hence, the maximum labor forces to be secured will be 25,000/day.

In taking daily working hours by eight hours and monthly working days by 25 days, the monthly labor requirement was estimated on the basis of the cropping acreages and seasonal working hours per unit acreage. (Ref. to Table IV-7)

The said table shows that the labor requirement for cotton harvesting in September is assumed to be about 24,000/day, which can be met with the labor supply of about 2.0 persons per family as mentioned above. Therefore, every family can manage to secure sufficient labor by family members, having no need to hire the labors.

Table IV-7. Monthly Farm Labour Requirements

(Unit: man-month)

Month	Year 3rd	4th	5th	6th	7th	8th	9th	10th	11th 1/
Jan.	-	420	840	1,225	1,650	2,075	2,080	2,085	2,125
Feb.	-	505	1,005	1,380	1,835	2,280	2,225	2,165	2,235
Mar.	-	325	645	1,230	1,755	2,285	2,490	2,700	2,650
Apr.	410	1,225	2,040	4,285	6,720	8,740	10,360	11,975	12,165
					(7,460)	(10,225)	(12,585)	(14,945)	(15,875)
May	1,150	2,295	3,445	6,020	8,885	10,610	12,335	14,050	14,345
					(9,625)	(12,095)	(14,560)	(17,020)	(18,055)
Jun.	1,185	2,375	3,560	6,410	9,250	10,925	12,580	14,240	14,240
Jul.	1,655	3,310	4,965	6,545	8,120	8,050	7,965	7,895	7,895
Aug.	1,150	2,305	3,455	5,640	7,825	8,860	9,895	10,930	10,930
Sep.	1,010	2,020	3,050	7,870	12,700	16,515	20,335	24,125	24,125
Oct.	2,285	4,570	6,865	8,080	9,290	8,220	7,155	6,075	6,075
	(6,900)	(13,800)	(20,710)	(23,445)	(26,185)	(22,020)	(17,860)	(13,690)	(13,690)
Nov.	695	1,395	2,090	2,705	3,325	3,245	3,160	3,085	3,085
Dec.	770	1,540	2,310	3,075	3,845	3,840	3,840	3,835	3,835

Notes: Number in parentheses shows labour requirements in case harvested without combines

1/ Monthly labour requirements in the 11th year are fixed through the whole project life after the 11th year

2) Land Holdings and Farming Works

i) Land holdings

Land holdings of the farmers to be settled in the Project Area will be realized by privately-owned system or leased system (leased from the Government). The both systems cannot be judged on which to be better because of having their own merits and demerits. In details, the privately-owned system will encourage the farmers to engage in the works because the lands become their own property, while the Government leasing system will prevent the large-scale land owners from generating. It is recommendable to determine the land holding system in depending upon the farmers' own will in due consideration that the country admits the both systems of privately-owned and Government leasing.

ii) Farm management

About 100 ha commanded practically by three branch canals should be one farming unit area, and 60 farmers should cover the area. The area of about 33 ha, commanded practically by one branch canal, is called a crop belt where only one crop shall be grown concentratively.

The proper arrangement of such crop belts will ensure the high efficiency of the water management and also enable to carry out a variety of farming works more effectively and economically through crop-intensive cultivation.

3) Organization of Farm Management

According to the direction for the farm management as above, one farming group, consisiting of 60 farmers, will be responsible for conducting collective works in farming, machine operation, purchase of farm inputs, marketing of the products and operation/maintenance of the irrigation facilities.

A chief or representative person of the group, elected from the members, will have responsibility to carry out the on-farm level water management and give guidances of farming works to the member farmers. The said group representative will participate in the administrative services of the small

village concerned as a member of the village assembly. The small village is composed with five to seven farming groups.

4) Farm Mechanization Plan

The proposed cropping pattern has presented the two alternatives of the farm mechanization plan for paddy and wheat harvesting. The first alternative proposes that paddy and wheat harvesting is carried out by combine, while the second proposes that all harvesting works are made manually and other farm works are practised by machines as much as possible, excepting paddy transplanting. The estimation of demand and supply of labor and cost calculation of the farm products have resulted in advantage, at present, in the second alternative that the harvesting works should be made manually. In future, however, the first alternative may be considered advantageous in taking into account the increase in the manual harvesting cost by increase in the labor wages.

IV-4. Project Formulation

IV-4-1. Water Balance Computation

1) Water Amount Available under Water Right

The irrigation water source for this Project is the El Salam Canal, the construction works of which are now in progress so that the first stage construction can be completed by 1984 as discussed already. The capacity of this canal is designed by 30 cu.m/feddan/day. Besides the above, an irrigation program is established for the South Hosainia District of about 73,000 feddans, for which 2.19 million cu.m/day of water are to be secured under water right.

2) Considerations on Water Requirements based on Proposed Cropping Pattern

The irrigation water requirements fluctuate in increasing or decreasing from kinds and strains of crops to be introduced, their sedding or transplanting periods, etc. In particular, in those projects like this Project that the main canal capacity is decided prior to determination of the cropping pattern, the crops to be introduced should be selected and arranged to control the crop water requirements for meeting the discharge

available as mentioned previously.

The proposed crops have been selected in cosideration of a variety of conditions such as meteorology, farm mechanization plan, labour requirement, expected benefits, etc.; paddy, cotton, maize, soiling corn as summer crops, while both varieties of berseem of four-time harvesting and two-time harvesting and wheat as winter crops. These crops will be gorwn in three-year rotation cropping pattern. However, among the said summer crops the change in seeding or transplanting period is available only for miaze and soiling corn but not for paddy and cotton because of climatic conditions. Hence, seeding period of maize and soiling corn will be varied to draw down the peak water demand in the summer season.

Maize is commonly sown for one month from May 15 to June 15 and harvested for one month from August 15 to September 15. For this ordinary seeding program, an alternative plan is prepared with some days advancement and same days delay in seeding time for water balance computation.

Especially, the following four patterns of soiling corn growing have been considered;

Case	Seeding		Harvesting	
1.	5/15 - 7/15	2 months	8/1 - 9/30	2 months
2.	6/1 - 7/15	1.5 months	8/1 - 9/30	1.5 months
3.	6/1 - 6/30	1.0 month	9/1 - 9/30	1.0 month
4.	6/15 - 7/15	1.0 month	9/1 - 9/30	1.0 month

The water balance computation was carried out according to 60 alternative plans in combination of the above crops. The said computation, detailed in Annex-E, has resulted in the Case 0-3 as most advantageous.

The above case-study suggests that the water shortage will take place by only 3.0 mm for 10 days, which is least as compared with other alternatives, and will be able to be sufficiently supplied with the supplemental water from farm ponds and the lake.