THE ARAB REPUBLIC OF EGYPT

MINISTRY OF IRRIGATION

FINAL REPORT

FEASIBILITY STUDY

FOR

THE SOUTH MARIUT AGRICULTURAL DEVELOPMENT PROJECT

(SMADP)

VOLUME 1

THE ARAB REPUBLIC OF EGYPT

MINISTRY OF IRRIGATION

FINAL REPORT

ON

FEASIBILITY STUDY

FOR

THE SOUTH HOSAINIA VALLEY AGRICULTURAL DEVELOPMENT PROJECT

(ANNEXES)

VOLUME-3

MARCH 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

GENERAL PLANNING MAP

LEGEND

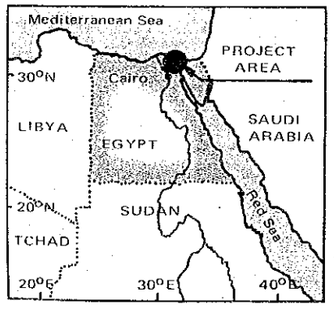
- DIVERSION FACILITY
- IRRIGATION CANAL
- DRAINAGE CANAL
- FEEDER ROAD
- VILLAGE ROAD
- SMALL VILLAGE
- SERVICE VILLAGE
- CENTRAL VILLAGE
- (P) PUMPING STATION FOR DRAINAGE
- (Pr) (Pb) PUMPING STATION FOR IRRIGATION
- LIVE-STOCK CENTER

Bahr Saft drain

El Salam canal

Bahr Baqar drain

KEY MAP



SCALE

0 1 2 3 4 5 Kilometres

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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

D-1. PRESENT CONDITIONS OF AGRICULTURE

D-1-1. Land Utilization

1) Conditions of Land Use in San El Hagar

Table D-1-1 and Table D-1-w show the conditions of land utilization in San El Hagar in 1961 and 1980 respectively. According to these tables, the total area of lands under cultivation has been expanded by about 11 times with average annual newly reclaimed area of some 2,000 feddans from 1961 to 1980. However, the cultivation area of fruit crops together with timber trees was as small as about 1,000 feddans in 1980 taking up only 2% of total cultivation area mainly because of the existence of local clayey soils with poor drainage.

Due to a lack of data on the local production of crops, no precise figures on the production and acreage of each crop in this area can be specified. In general, however, only rice and berseem are usually grown as so-called "reclamation crops" for a few years after leaching has been completed in newly reclaimed areas in San El Hagar. After this initial reclamation period, only salt-tolerant crops are cultivated for some 10 years depending upon the situation. After this final stage of reclamation period, relatively salt-sensitive crops together with vegetables could be grown to some extent in those areas.

2) Present Conditions of Agricultural Land Use in the Project Area

In accordance with the results of the topographical survey, it has been verified that there are 2,500 ha (5,950 feddans) of existing cultivated lands in the project area. However, no official statistical data on those cultivated lands are available.

General cultivation practices or conditions in this area are almost identical with those in such areas as San El Hagar adjacent to the project area excent for the lower land productivity because of its limitted water resources available.

The present local cropping pattern for the cultivated lands of 2,500 ha is shown Fig. D-1-1 and estimated average crop production is as follows:

Table D-1-1 Land Use in San El Hagar as of 1961

(Unit : feddan)

Item		Area
1. Cultivated Land		
a) Field crops & vegetables		3,926
b) Orchards, Timber Trees & Nurseries		0
	Total :	3,926
2. Non-Cultivated Land		
a) Public Utilities, Roads and Canals		1,574
b) Buildings & Barns		
1) Private		0
2) Public		4
	Sub-total :	4
c) Waste Land		
1) Private		20
2) Public		27,793
	Sub-total :	27,813
	Total :	29,391
	Grand total :	33,317

Data Source : The Fourth Agricultural Census, 1961

Table D-1-2 Land Use in San El Hagar as of Sep. 1980

(Unit : feddan)

Item		Area
1. Cultivated Land		
a) Field crops & vegetables		42,000
b) Orchards, Timber Trees & Nurseries		1,000
	Total :	43,000
2. Non-cultivated Land		
a) Public Utilities, Roads and Canals		3,000
b) Buildings & Barns		
1) Private		1,500
2) Public		0
	Sub-total :	1,500
c) Waste Land		
1) Private		0
2) Public		0
	Sub-total :	0
	Total :	4,500
	Grand total :	47,500

Data Source : Ministry of Land Reclamation (San el Hagar office)

Crop	Area (ha)	Yield (ton/ha)	Production (tons)
Cotton	800	1.1	880
Rice	1,600	2.9	4,640
Wheat	800	1.6	1,280
Vegetables 1/	200	8.0	1,600

Note : 1/ Mainly tomatoes

In addition to these crop items, some berseem is also grown during the winter season to be fed to draft animals owned by small farmers.

In spite of the land reclamation operations which have been done intensively by the settlers, the development process of the land productivity has been retarded due to the incomplete irrigation and drainage system in this area.

It should be noted that almost no lands are utilized for growing fruit crops because of the local edaphic conditions which will adversely affect the growth of trees.

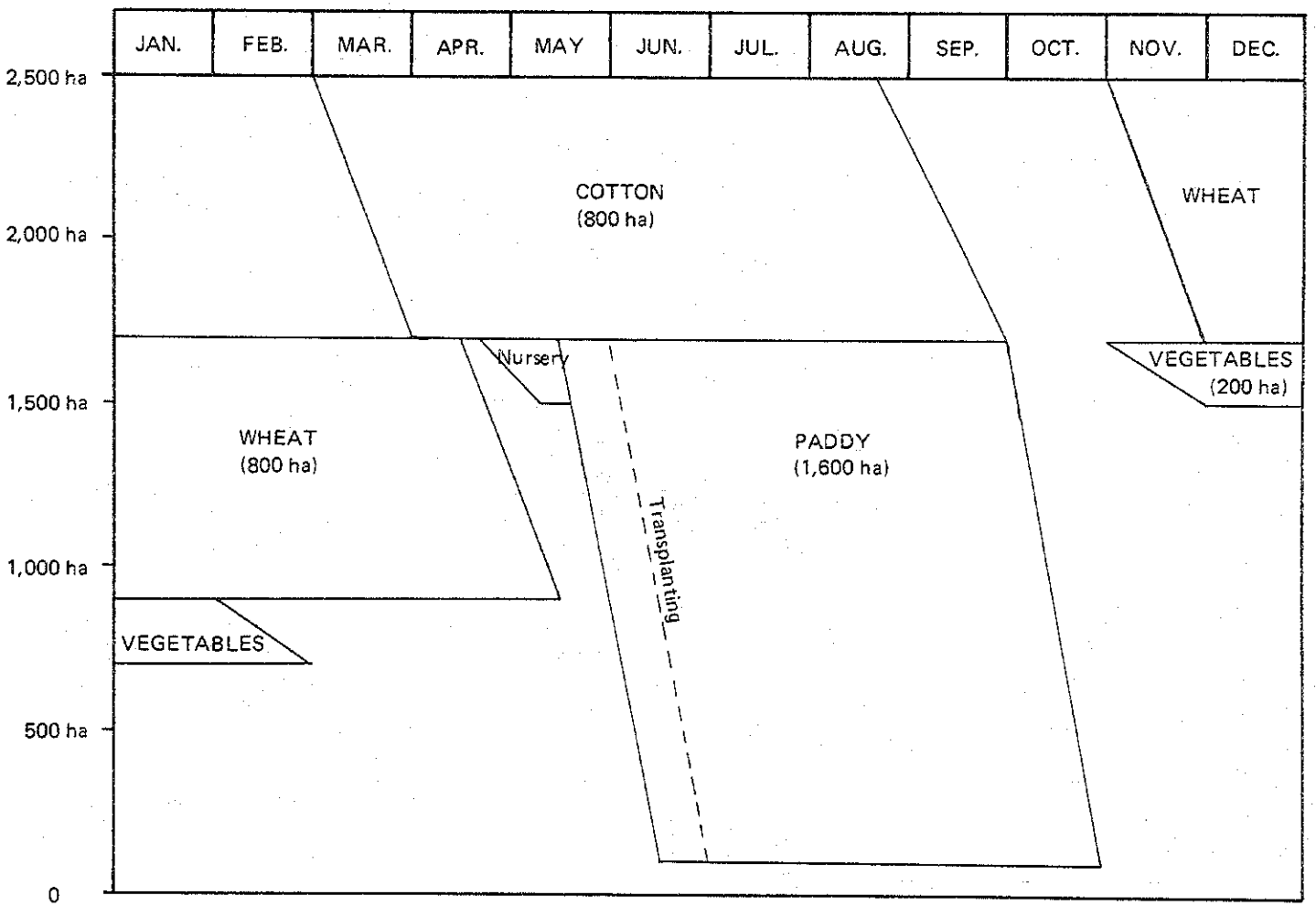
D-1-2. Agricultural Production

1) The Present Cropping Pattern in the Sharkia Governorate

The most important summer crops in the Sharkia Governorate are cotton, rice and maize. They are planted in the early summer season and harvested in September or October. Of those three summer crops, the cultivation area of maize is largest and was twice as large as that of cotton in 1979.

On the other hand, berseem and wheat are the most important winter crops in this area. Total cultivation area of full-term and catch-cropping berseem was about twice as large as that of wheat in 1979.

Fig. D-1-1 Present Cropping Pattern



The total cultivation area of those five kinds of crops covered more than 80 percent of the total cropping area with the cropping intensity of about 190 percent in 1979 in this area. Those five main crops are cultivated in the 3-year rotation system.

Most of the fruit crops with the total cultivation area of about 37,000 feddans in 1979 are grown in sandy areas with good drainage in this area. In sandy and clayey areas which have been already reclaimed enough, vegetables such as tomatoes are also produced. However, the total cultivation area of vegetables was only about 40,000 feddans in 1979. (For details on cultivation area and local cropping schedule, see Appendix D-1-1)

2) Present Conditions of Crop Cultivation System & the Amount of In-put Materials

(i) Present cultivation method of main crops

a) Rice

In San El Hagar, the rice plant is grown by the direct seeding method for the first few years in newly reclaimed areas. After this period, rice seeds are sown at the rate of 60 kg/feddan (main fields) in nurseries around the first of May and one month old seedlings are transplanted to main fields which are puddled in advance. The area of nurseries is somewhere between 10 and 13% of the area of main fields.

Urea with 46% of nitrogen is applied at the rate of 100~150 kg/feddan. Of this amount, some urea is top-dressed one or two times at a rate of 50 kg/feddan during the growing period.

Usually, harvesting operations are not mechanized yet. However, most of the plowing is done by tractors. Irrigation is done in the 4-day rotation system.

In San El Hagar, it is reported that 30 skilled-man-days and 53 unskilled-man-days of labour are required for the production of rice per feddan by the direct seeding method. (For details, see Appendix D-1-2)

b) Berseem

In San El Hagar, seeds of berseem are sown at the rate of 20~25 kg/feddan during the period of Sep.15 through Oct.15. If cultivated in rice fields, they are sown when the rice plants are still standing in the fields. Therefore, no plowing operations are required. Usually, no nitrogenous fertilizers are applied. After seeding, it takes about 60~70 days for the first cutting to be taken. After the first cutting, harvesting can be done approximately every 40 days. Thus, full-term berseem provides 4 cuttings and catch-cropping berseem 2 cuttings. At the time of the first and second cuttings, superphosphate is top-dressed.

It is reported that 10 skilled-man-days of labour are required for the cultivation of full-term berseem in San El Hagar. (For details, see Appendix D-1-2)

c) Cotton

About 60 kg of cotton seeds per feddan are sown on ridges. Several seeds are sown at one place. After 40 days, the cotton plants are thinned, when the first nitrogenous fertilization is done as a top-dressing fertilization. Superphosphate with 15% of P_2O_5 is applied as a basic fertilizer at a rate of 100 kg per feddan.

Pest and insects on the cotton plants are removed mechanically with hands by farmers when they are at the earlier stage of growing period. However, they are controlled chemically at the later stage.

Cotton seeds with fibers are harvested with hands when approximately 60 days have passed since the time of flowering of the plants.

It is reported that 54 skilled-man-days and 101 unskilled-man-days of labour are required for the cultivation of cotton in San El Hagar. (For details, see Appendix D-1-2)

d) Wheat

60 kg of seeds per feddan are scattered in the fields in November. Nitrogenous fertilizers are applied to the wheat plants when they are about 40 days old. Usually, no phosphoric fertilizers are applied to wheat. Harvesting operations are not mechanized yet.

It is reported that 19 skilled-man-days and 6 unskilled-man-days of labour are required for the cultivation of wheat in San El Hagar. (For details, see Appendix D-1-2)

e) Maize

20 kg of seeds per feddan are sown on ridges around the first of May. The first nitrogenous fertilization is done when the plants are about 40 days old. After 2 weeks, the second one is done. No phosphoric fertilizers are applied.

It is reported that 35 skilled-man-days and 15 unskilled-man-days of labour are required for the production of maize in San El Hagar. (For details, see Appendix D-1-2)

(ii) Amount of agricultural in-put materials

The maximum amount of fertilizers to be applied per feddan is fixed every year by the government. The actual amount of fertilizers applied per feddan by farmers is close to this fixed amount. Therefore, the total amount of fertilizers needed for a particular area is estimated by the government in advance and that amount of fertilizers is distributed to the farmers in the area through the governmental distribution system.

In 1980, the fixed nitrogenous fertilization level for rice, cotton, wheat and maize was 200 kg, 350 kg, 325 kg and 400 kg per feddan respectively in the equivalent of calcium nitrate with 15.5% of nitrogen. (For details, see Appendix D-1-3)

The appropriate amount of seeds to be sown per feddan for main crops is presented by the government. The actual amount of seeds sown by farmers is also close to this amount. (For details, see Appendix D-1-4)

The appropriate amount of some spraying materials for main crops per feddan is also presented by the government. (For details, see Appendix D-1-5)

3) Crop Production

(i) Conditions of main crops cultivation

The conditions of national production of main crops may be characterized by the large annual production of more than 1-3 million tons for each of such crops as rice, wheat, maize, cotton, potatoes and tomatoes. It should be noted that the production of berseem is also extremely high although no precise data on that are available.

Regarding the annual cultivation area of each of the so-called "Egyptian five major crops" such as cotton, rice, berseem, maize and wheat in the Sharkia Governorate, it has been somewhere between 10% and 17% of the total national cultivation area respectively over the past five years. It is noticed that the percentage share of the Sharkia Governorate in the total rice cultivation area in Egypt has been especially large ranging from 15 to 17%. Furthermore, it can be pointed out that there have been no significant acreage fluctuations for each of the five crops in the governorate over the past five years. Consequently, it could be said that the Sharkia Governorate is one of the most important cereals-producing areas in Egypt.

It is interesting to note that the share of the Sharkia Governorate in the total national annual acreage of catch-cropping berseem has been higher than that for full-term berseem. This is supposed to be due to the large acreage of cotton which usually follows the cultivation of catch-cropping berseem in the governorate.

Regarding some other main crops, it should be stated that the share of the Sharkia Governorate in the total national cultivation area of such pulse crops as fenugreeks, beans, lentils and chickpeas has been small over the past five years. Especially that for lentils, chickpeas and fenugreeks has been considerably low and has had a tendency to be decreased. That for beans was very close to 7% in 1979 and also has had a tendency to be decreased. That for sugarcane and sesame has been less than 1% respectively. That for potatoes has been increased although it was as small as 1.4% in 1979. The cultivation area of this crop in the Sharkia Governorate has been increased by about four times from 1975 to 1979. Finally, that for the rest of the main crops has been more than 10% respectively in the past five years.

The average yield per feddan of cotton seed and lint cotton in the Sharkia Governorate has been higher than the national average by some 0.2 tons and 0.06 tons respectively. The average yield of barley, potatoes and flax straws has been also higher than the national average.

On the other hand, the average yield of such pulse crops as fenugreeks, lentils and chickpeas and sesame has been lower than the national average respectively. Judging from this low yield, it would be reasonable that the acreage of those crops be small in the Sharkia Governorate. Therefore, it may be conceived that the natural conditions in the Sharkia Governorate are generally not suitable for the cultivation of those crops.

Regarding the average yield of other crops, it has been close to the national average.

It is interesting to note that the extremely small cultivation area of sugarcane in the Sharkia Governorate which has had the average yield close to or higher than the national average over the past five years is due to some artificial limiting factors such as cultivation policies, competitions with other crops, etc.

(ii) Conditions of vegetables production

The national production of watermelon is highest with annual production of more than 1 million tons. The annual national production of squash, cabbage, cauliflower, eggplant, pepper, melon and cucumber has exceeded 100,000 tons respectively in the past five years. Annual national production of greenbeans, lettuce and carrot has been increased gradually and exceeded 100,000 tons in 1979 respectively. On the other hand, in the Sharkia Governorate, the production of squash only has been as large as 100,000 tons annually over the past five years.

Regarding the acreage of vegetables, the Sharkia Governorate has contributed some 20% of the total national cultivation area of squash. The percentage share of the governorate in the total national acreage of taro has been as large as some 50%, but the acreage itself was only 3,610 feddans in 1979. That for Egyptian mallow has been also as high as some 40% but the acreage has been extremely small. However, that for greenbeans, Jewish mallow, turnip, carrot, watermelon and melon has been less than 6% and the acreage has been less than 1,000 feddans respectively. That for the rest of the vegetables has been approximately 10% with some yearly fluctuations.

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. For example, the average yield of eggplant per feddan in the governorate has been higher than the national average by 2-3 tons, that of taro by about 2 tons and that of Egyptian leek by 2-4 tons. On the other hand, the average yield of spinach, radish and melon in the governorate has been somewhat lower than the national average by 1-1.5 tons/feddan respectively.

As the above, the cultivation area of the vegetables with high yields is not always large proportionate to the degree of their high yields in the Sharkia Governorate. However, this may be partly due to the possibly small limited area of local lands which are suitable for the cultivation of such vegetables in the governorate. It is also considered that the production of such vegetables with high yields may be mostly concentrated in the areas best suited for them. Consequently, the production of such crops as eggplants with potentially high yields in the governorate could be expanded provided that the produce can find its way onto a large market in the future.

As a result of the comparative studies of vegetables production as the above, it may be concluded that most of the natural conditions such as local climate have not been adversely affecting the expansion of vegetables production and that some other factors such as edaphic conditions, competitions with major crops for limited cultivation area, economic conditions and agricultural policies have been controlling the potentialities of vegetables production in the Sharkia Governorate.

(iii) Conditions of fruits production

The annual total production of citrus has been close to as much as 1 million tons in the whole country over the past five years and that of dates, grapes, mangoes, bananas and guavas has been approximately 100,000 tons respectively.

However, the production of only citrus, mangoes and dates of those six fruit crops has been relatively high in the Sharkia Governorate representing about 17%, 40% and 13% of the total national produciton respectively in the past five years. Regarding other fruit crops, the governorate has accounted for less than 3% of the annual national production of each of them.

The Sharkia Governorate has been contributing about 15%, 30% and 7% of the national cultivation area of citrus, mangoes and dates respectively over the past five years. It is noticed that the

acreage of these three fruit crops has been gradually increasing in both the Sharkia Governorate and the whole country. Incidentally, comparative studies on the average production per unit area of fruits will be inappropriate since it is dependent upon the age of trees to a great extent.

As the above, it may be concluded that the Sharkia Governorate is a very important producer of mangoes, citrus and dates in Egypt. However, it is well known that the governorate has generally two definitely different types of areas with sandy soils or clayey soils. Clayey areas are endowed with fertile alluvial deposits containing light to heavy clays. The sandy areas are considered to be suitable for the cultivation of fruits and vegetables and have been planted to a great number of fruit trees. In this regard, local edaphic factors together with the general natural conditions for farming in the surrounding areas should be taken into account to evaluate the suitability of the new settlement area for any kinds of particular crops. (For details, see Appendix D-1-6)

4) Present Conditions of Livestock Industry

(i) Conditions of livestock production

The number of cows, buffaloes and sheep in Egypt was approximately 2.6 million respectively in 1978. The number of chickens was about 27 million in 1978. Those four kinds of livestock have been playing an important role in the establishment of livestock industry in Egypt. (For details, see Appendix D-1-7)

It is estimated that more than 70% of the cows are owned by small farmers to be utilized for farming operations 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.

Whereas, it is reported that the number of cows and buffaloes in the Sharkia Governorate was approximately 180,000 and 170,000 respectively in 1978.

In San El Hagar, some 2,000 cows are raised for the prcduction of beef meat by five semi-governmental companies. Usually, those companies start raising of fatterning cows at the age of 12-14 months which are brought from the market in Zagazig, Manzala, etc. Concentrated feed materials produced in Egypt form cotton seed cakes, yellow corns, wheat bran, rice bran and molasses together with green fodders are fed to those cows. After 6~8 months, when each of the cows weight about 400 kg, they are slaughtered in Zagazig, etc.

(ii) Some bottle-necks in the promotion of livestock industry

There are some bottle-necks which should be removed for the further establishment of livestock industry in Egypt as follows:

- Production of concentrated feed materials should be expanded
- Price or producing cost of Egyptian berseem should be reduced
- Production of summer green fodders should be expanded

In addition, the following items will make it possible to improve the situation of livestock produciton:

- Variety improvement through utilization of artificial insemination method with good frozen semen from foreign countries.
- Improvement of veterinary services
- Prevention of slaughtering of female cows
- Livestock protection from parasites

(iii) Conditions of livestock utilization for farming operations

Currently, it is reported that about 40% of the plowing operations are done by animals in Egypt. Some 50% of the threshing operations for rice and wheat are done by using animal power. Most of the lifting operations of irrigation water are still done by water wheels with the name of "SAKIYA" mobilized by draft animals. It is reported that more than 60% of all working time of animals is presently spent on this particular irrigation work.

D-1-3. Prices of Agricultural Products and In-put Materials

1) Prices of Agricultural Products

Presently, the government is controlling production of some main crops of which governmental purchasing prices are given in Appendix D-1-8. 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 put any surpluses of their products into the private distribution system after accomplishing the quotas for the agricultural products controlled by the government. Appendix D-1-9 shows the average farm gate prices of main crops in the entire Egypt and the Sharkia Governorate respectively, which are privately traded.

2) Prices of Agricultural In-put Materials

The government has been distributing necessary agricultural in-put 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 in-put 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. Each farmer is able to purchase, at the governmental subsidized prices, certain amount of fertilizers determined based on the maximum fertilization levels as fixed by the government according to the local soil fertility.

However, additional amount of fertilizers which exceed the government-fixed fertilization levels is to be purchased at the non-subsidized higher prices.

D-1-4. Farming Management Conditions

1) Land-holding Conditions

It is reported that the average area of each of the villages numbering about 4,000 in Egypt is approximately 15,000 feddans. Since the average number of land-holders in each village is estimated at 500, the average unit holding area is approximately 3 feddans.

However, in San El Hagar, it is reported that each cooperative organizes about 250 farming families with the total cultivation area of some 1,300 feddans. Therefore, the average farming area for each family is about 5 feddans. Approximately 50,000 people are inhabiting San El Hagar with the total cultivation area of some 43,000 feddans.

2) Farm Mechanization Conditions

It is reported that the total number of tractors, pumps of 7-10 p.s. and threshers currently in operation are 26,000, 21,000 and 14,000 respectively in Egypt. Since the annual total national cultivation area is about 11 million feddans, 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 a few types of machinery farming operation services available 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 groups are available, for reasonable operation charges, to farmers who do not belong to the groups.

(ii) Cooperative operation services

It is reported that machinery farming operations for less than 10% of the total annual cultivation area are done by utilizing the machinery services offered by cooperatives. Cooperative machinery operation charges are less than the actual costs, 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 are less than the actual costs, since they are subsidized by the government.

Incidentally, Appendix D-1-10 shows the standard charges for seedbed preparation work done by tractors or draft animals through cooperatives or private sectors in 1979. As specified, cooperative charges were somewhat less than private sector's charges.

D-1-5. Supporting Organization for Agricultural Development

1) Research and Extension Activities

(i) Research activities

The agricultural Research Center located at Giza which is administered by the Ministry of Agriculture has been responsible for all types of governmental agricultural research activities since 1971, when the function of each of the research departments of the Ministry of Agriculture was transferred to this research center.

Many new technologies and crop varieties developed by the research center have been put into practical use through a lot of extension workers all over the country.

Presently, the research center organizes 11 research institutes covering the fields of agronomy, soil science, animal science and agricultural economics. In addition to those institutes, the research center has some agricultural research stations distributed in both upper and lower Egypt regions. (For details, see Appendix D-1-11) Usually, research on plant breeding has been placed the first priority among many types of agricultural research activities in Egypt.

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

(ii) Extension services

Governmental bodies involved in agricultural extension organization in Egypt are well organized at both central governmental and local governmental levels.

At the central governmental level, under-secretary and the high advisory council for extension services are responsible for actual programming, methodology and strategy development, and administration of extension services in cooperation with each department with some specialized divisions. (See organizational structure shown in Appendix D-1-12)

At the local governmental level, extension inspectors are responsible for the execution of extension services planned by the central government. Extension inspectors for districts are administering extension agents in each regional area who are responsible for educating local farmers and transferring modernized agricultural technologies to them. (See organizational structure shown in Appendix D-1-13)

Some 10 local leaders with good agronomic knowledge and human characteristics are selected in each village by extension agents. Currently, about 2,200 extension agents are working on extension programmes in approximately 4,000 villages all over the country. Those extension agents with the academic qualification of Bachelor's degree of science are also responsible for collecting agronomic data obtained at each village.

In each village, 4 ha of field-plots with good irrigation and drainage system belonging to some of the local leaders are utilized as demonstrational plots which are usually located beside main roads so that the demonstrational presentation of advanced cropping

technologies can be appreciated by as many local farmers as possible with easy access to those plots. The purpose of the establishment of those demonstrational plots is to transfer new technologies and to release new varieties to local farmers developed by the governmental research organization. The successful conditions of crop cultivation presented at demonstration plots have caused many local farmers to accept new technologies who tend to be reluctant to accept technological and biological innovations because of their conservative way of thinking concerning the traditional farming practices. Crop cultivation at the demonstration plots is subsidized by the governmental organization and some agricultural contests are conducted in order to give farmers an incentive to improve their farming methodologies.

In addition to the extension services organized by the Ministry of Agriculture, Ministry of Land Reclamation is also responsible for providing new settlers with extension services in newly reclaimed areas. Agricultural engineers and assistant engineers who belong to the Ministry of Land Reclamation work on extension services. Each assistant engineer covers about 500 feddans of reclaimed lands. They offer educational presentations for settlers concerning crop rotations, fertilizers, pesticides, seeds, farm mechanization, etc.

D-2. AGRICULTURAL DEVELOPMENT PLAN

D-2-1. Land Utilization Plan

1) Land Area by Utilization Items

Table D-2-1 shows the conditions of the present land utilization in the project area and the future land utilization after completing the project implementation.

As shown in the table, 18,400 ha of new net cultivation area will be added to the present net cultivation area with the project.

All of the presently submerged lands of 12,200 ha will be dried up to be put into any practical utilization. All of the potentially arable lands of 16,500 ha which are presently not cultivated will be utilized as crop fields with the project. The lands itemized as "others" will cover 10,500 ha all together.

2) Basic Land Utilization Strategies

Each part of the cultivated lands in the project area will be composed of certain number of rotational unit zones, each of which consists of 60 field plots planted to all of the proposed three summer crops in the 3-year rotation system. Therefore, no field plots are to be specialized for any particular crop according to the agronomic land nature and properties as clarified in the land classification system. However, it would be concluded that there will be no significant differences among classified agricultural lands in terms of their productivity of any one of the crops in the proposed 3-year rotation system. Thus, about 200 unit rotational zones will be distributed evenly throughout the project area.

All of the lands of 10,500 ha which are not to be cultivated will be utilized for certain purposes as specified in the table. With respect to the actual utilization of the non-arable waste lands with the total area of 600 ha, they will be utilized as multi-purpose sites

Table D-2-1

Land Utilization Conditions in the Project Area

(Unit : ha)

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

Note : Area shown in parentheses is in feddan.

1/ Details are as below

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

where various types of garbages, city sewage from each village, cattle excreta from the livestock centers, etc. will be disposed of or dumped off. They will be dried up, buried into the ground or incinerated depending upon the situation and the items concerned.

D-2-2 Agricultural Production Plan

1) Selection of Candidate Crops for the Potential Cropping Patterns

(i) Major factors for the determination of candidate crops

It is conceived that major agro-factors which would govern the potential cropping patterns in a particular area are natural and/or artificial conditions of local climate, indigenous soils, hydrology cum irrigation water resources, agricultural produce marketability, fundamental policies or strategies for organized agricultural development, etc. Consequently, those factors associated with the south Hosainia project area would be characterized as follows:

a) Local climate

Annual average precipitation is extremely limited ranging from some 50 to 100 mm with seasonal fluctuations. Thus, the local agriculture is completely dependent upon artificial irrigation resorting to the water resources of the Nile river. Although the temperature is generally high, especially in the summer season, with the yearly average temperature close to 20°C, many of the agronomic crops found in the temperate zones have been grown in the surrounding areas. Judging from some existing meteorological data for neighbouring cities, the yearly average velocity in the project area would not exceed 5 m/s. Consequently, windbreaks such as trees around the fields to protect crops from strong winds and sand storms would not be always necessary. Annual evaporation level is approximately 2,000 mm having a great influence upon the crop water require-

ments. It is considered that other climatological factors such as solar radiation, photo-periodicity, humidity, etc. are not having adverse effects on the productivity of local agronomic crops.

As the above, it may be concluded 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.

b) Indigenous soils

Most of the soils in the project area would be classified as clayey soils with heavy to light texture. The soils are very saline due to impeded drainage and the high table of groundwater with extremely high salinity. For this reason, although leaching operations which will be applied to the project area can be expected to remove the salts in the soils to the extent that most of the crops are able to grow well, salt-tolerant crops should be selected as candidate crops for the cropping patterns. Incidentally, in the early stages of the project life, the growth of any fruit crops with deep root-zone will be retarded or stunted due to the effects of the initial high water table even after the leaching operations together with the establishment of drainage system have been completed.

c) Hydrology cum water resources

As would be the case for other irrigated agricultural lands in Egypt, the fresh canal water is to be mixed with drainage water with high salinity to be utilized as irrigation water for the crops in the project area. Through manipulating the mixing operation, the salinity of the irrigation water is planned to be maintained about 800 ppm. Although this level of irrigation water salinity would not be hazardous to the normal growth of crops, there is a great deal of possibility that the continuous irrigation with this mixed water will accumulate salts in the soils.

The relatively high evaporation rate and heavy clay texture peculiar to the project area may enforce and facilitate this process.

In this connection, utilization of salt-torelant crops or varieties in the project area will be the most fundamental agronomic strategy for the crop production scheme.

d) Marketability

It would be expected that any agricultural produce derived from the project area will exert not a little impact on the regional or domestic market. In this respect, according to the demand projection for agricultural produce conducted by the government/FAO in 1973, the level of domestic demand for all kinds of main agricultural produce, except maize and millet flour, in 1980 would be expanded by 14-26% depending on the produce in 1985. This projected rapid demand increase is closely associated with expected rapid population and income increase. (For details, see Appendix D-2-1)

e) Governmental policies

Within the framework of the Five-Year Plan, two strategic approaches to national agricultural development, "horizontal expansion" and "vertical expansion" have been clarified. Horizontal approach purports to expand agricultural production through increasing total cultivation area together with the promotion of mechanized farming. New land reclamation and greening of deserts will contribute to this approach. On the other hand, vertical approach intends to expand agricultural production through raising unit area yield resorting to biological innovation and intensified farming methods.

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

(ii) Justification of crop selection for the cropping patterns

Taking into consideration the above-mentioned factors associated with successful production of crops in the project area, the following canditate crops have been selected for the establishment of the cropping patterns:

a) Rice

The local climate is considered to be suitable for the production of rice. The rice production in the Sharkia Governorate where the project area locates was as much as 15.5% of the total domestic production in 1979.

From the viewpoint of botanical physiology, the rice plant grows well in the clayey heavy soils which widely exist in the project area. The rice plant is highly resistant to salts and the downward movement of soil moisture deep to the drainage system caused by the continuous submerged conditions of the paddy fields will prevent the harmful salts from accumulating in the upper layers of the soils. According to the demand projection study, the rate of increase in the domestic demand for milled rice from 1980 to 1985 is expected to be about 17%. Furthermore, within the framework of Five-Year Plan, the production expansion of such potentially export-oriented crops as rice has been encouraged.

b) Cotton

The productivity of cotton grown in the Sharkia Governorate has been higher than the average one in Egypt mostly because of the better local climatic and edaphic conditions than those in other regions. For example, the average yield of lint cotton for the Sharkia Governorate was 0.416 tons/feddan and the national average was 0.369 tons/feddan in 1978. The cotton plant has high salinity-resistance and will be growing in the project area with irrigation water of some salinity. As the most important cash crop in Egypt, production of cotton in the project area will be of great importance.

The estimated rate of increase in the level of domestic demand for lint from 1980 to 1985 is 19% according to the demand projection study.

c) Berseem

Relatively favorable crop-ecological conditions for berseem have been making it possible to cultivate it widely in the Sharkia Governorate. This forage crop grown in the Sharkia Governorate took up some 13% of the total berseem cultivation area in Egypt in 1979.

As indicated in the Five-Year Plan, the expansion of meat production is supposed to be playing a role in the domestic agricultural development. In this regard, berseem as the most important forage crop in Egypt should be produced to promote livestock production in the project area.

d) Wheat

The Sharkia Governorate had produced 226,114 tons of wheat contributing about 12% of total domestic production in 1979. Local climatological conditions are considered to be relatively favorable for wheat cultivation in the region.

According to the demand projection study, rate of increase in the level of domestic demand for wheat flour from 1980 to 1985 would be about 17%. On the other hand, the total amount of wheat imported in 1979 was as much as 2,251,934 tons.

e) Maize

Maize production in the Sharkia Governorate was 412,580 tons contributing some 14% of the total domestic production in 1979. The local climatological conditions are favorable for maize production. It is salt-torelant enough to be introduced to the project area.

Although no increase in the domestic demand for maize could be expected in the near future according to the demand projection study, the amount of maize imported in 1979 was as much as 493,871 tons. Furthermore, in the Five-Year Plan, the necessity of strategical expansion of maize production has been noted. In addition, production of green fodder maize as a valuable summer roughage will play a role in the promotion of livestock industry.

Consequently, in accordance with this strategy, maize production should be promoted in the project area.

2) The Cropping Pattern

As a local farming practice, after leaching operations have been completed in newly-reclaimed areas, a few kinds of crops such as rice, berseem and barley are exclusively grown as initial reclamation crops in the areas adjacent to the project area. Those salt-tolerant crops can be expected to grow to some extent even in the most recently leached clayey soils which will still make the crops subject to relatively high soil salinity.

In addition, during this period of initial reclamation, relatively large amount of irrigation water needed for the cultivation of those crops will further facilitate and enforce the natural soil leaching process caused by irrigation.

Thus, in the proposed cropping pattern shown in Fig. D-2-1, only rice and berseem will be 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 will be also grown in the 3-year rotation system as shown in Fig. D-2-2. Basically, in the 3-year rotation system, the whole cultivation area will be divided into three blocks and each block will be planted to cotton, rice or maize respectively as a summer crop.

During this period of 3-year rotation, the chemical and physical properties of the clayey soils will be gradually improved to the point that somewhat salt-sensitive crops can be grown on the soils.

Therefore, after completing this 3-year rotation a few times, there will be some possibilities that some other cash crops such as vegetables, oil crops, etc. could be involved in the cropping pattern depending upon the soil chemical and physical conditions.

3) Cultivation Practices with the Project

(i) Rice

Rice will be grown by "the direct seeding cultivation method" for the first three years in the initial reclamation period.

During this period, it could not be economically reasonable to allocate any labour force to the transplanting of seedlings due to the extremely low yields expected. In addition, the longer irrigation period needed for "the direct seeding cultivation method" will further speed up the natural soil leaching process. (For details on the cultivation system, see Appendix D-2-2)

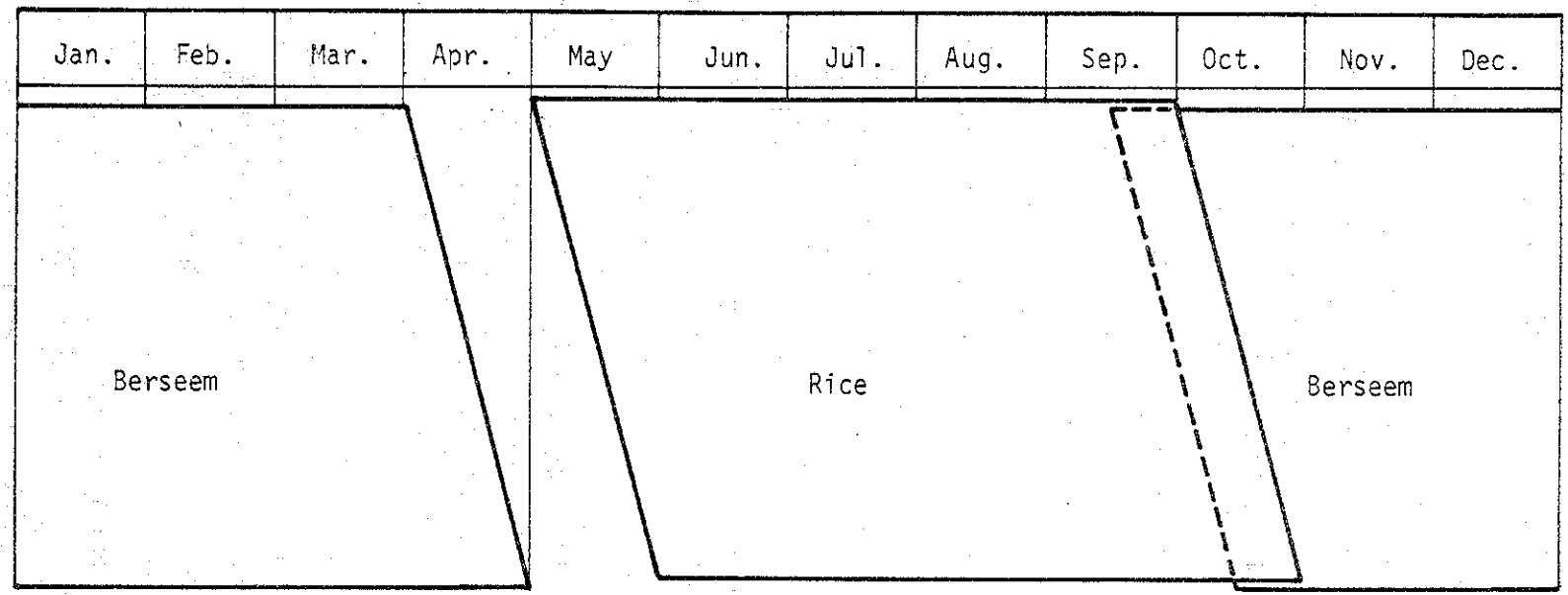
After this period, however, rice will be grown by "the transplanting cultivation method" in 3-year rotation system. This cultivation method will save irrigation water and increase the unit rice yields. (For details on the cultivation system, see Appendix D-2-3)

As a local method recommended by the government, 3-4 seedlings should be transplanted per hill at the planting space of 15 x 20 cm in the proposed cultivation system. However, the possibility of widening this planting space should be studied in the future from an economical point of view.

The ratio of nursery area to main field area is high ranging from 1:8 to 1:10 in Egypt due to the relatively high planting density

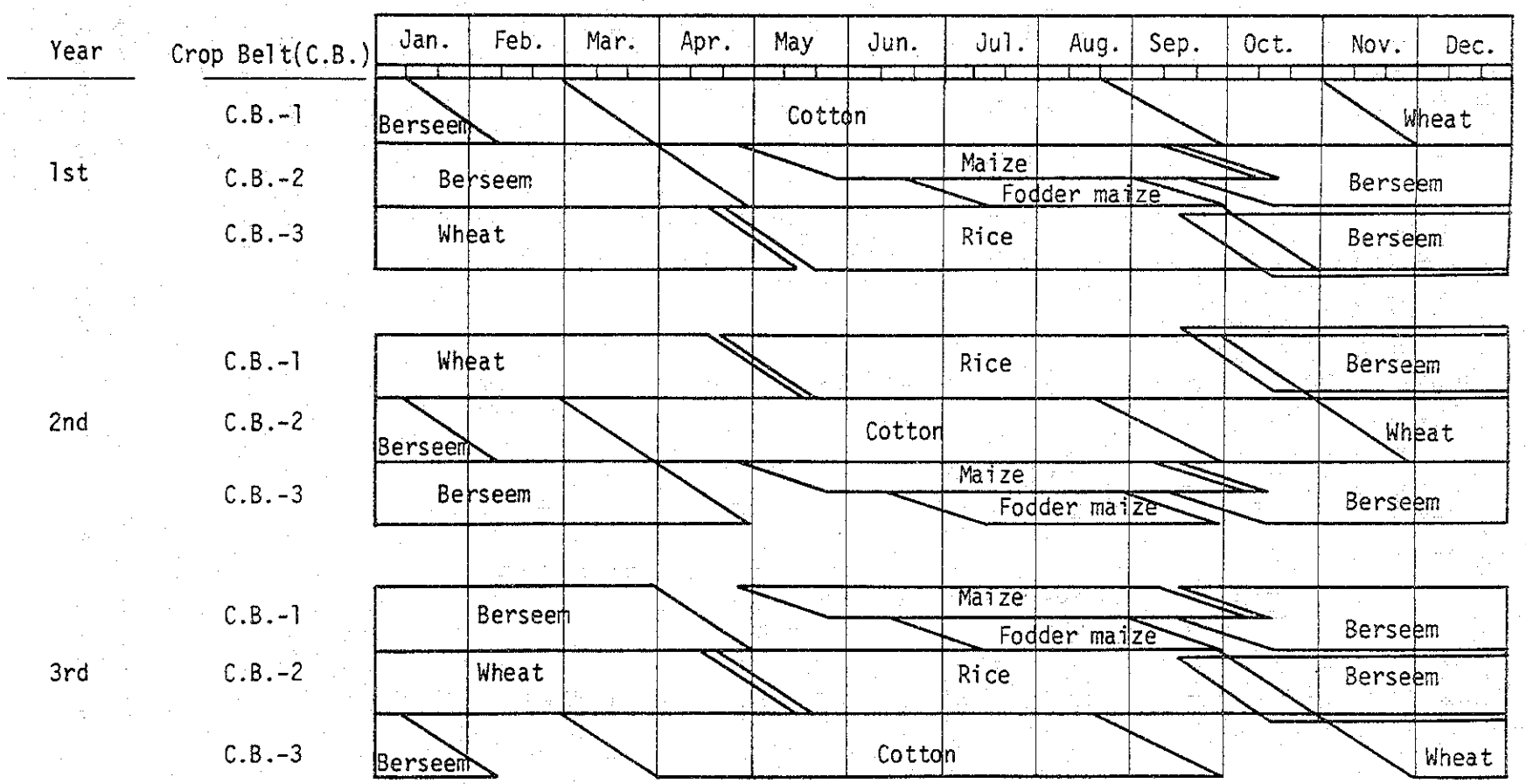
Fig. D-2-1

The Cropping Pattern of Initial Reclamation Cropping 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. D-2-2 The Cropping Pattern of 3-Year Rotation[1/]



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

because of the low tillering rate caused by the unfavorable physical conditions of nurseries such as uneven land levelling, etc. and also to low germination rate of seeds locally available. The possibility of lowering this ratio should be also studied to minimize the amount of in-put materials and labour force needed for the growing of seedlings to be transplanted.

Since the rice plants grown in the project area may be subject to somewhat adverse effects of salts from irrigation water mixed with some drainage water, utilization of such rice variety as Giza 159 with high salt-tolerance will be recommended.

The possibility of utilizing transplanting machines should be also studied in the future.

(ii) Berseem

When cultivated in the rice fields, the seeds of berseem will be scattered among the rice plants and no field preparation operations 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. (For details on the cultivation system, see Appendix D-2-4)

(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.

Insects control will be done in two ways as a traditional local farming method. In the early stage of the plant growth, eggs and

small larvae of pest insects will be removed mechanically with human hands and in the later stage, they will be controlled chemically by spraying insecticides.

Row spacing is designed to be 0.9 m. The planting space of 0.9 x 0.4 m will be recommended. Seeds will be sown at the planting interval of less than 20 cm on the same ridges and the plants will be thinned to adjust the plant population. (For details on the cultivation system, see Appendix D-2-5)

(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.

Any rust-resistant varieties with the cultivation period of about 145 days should be utilized in the proposed cropping pattern. (For details on the cultivation system, see Appendix D-2-6)

(v) Maize

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.

Any varieties with the cultivation period of about 105 days should be utilized in the proposed cropping pattern. Planting space of 90 x 20 cm will be appropriate, thus providing the planting density of about 56,000 plants per ha. Seeds will be sown by seeding machines at a planting interval of less than 10 cm on the same ridges and the plants will be thinned at their early growing stages to adjust the plant population at the target rate. (For details on the cultivation system, see Appendix D-2-7)

However, for the cultivation of green fodder maize, the planting interval on the same ridges should be less than 20 cm and on thinning operations should be done. (For details on the cultivation system, see Appendix D-2-8)

For details on the total amount of in-put materials needed for each crop, see Appendix D-2-9.

4) Target Yield

The target yields of some main crops in newly-reclaimed areas which have been fixed by the Ministry of Land Reclamation based upon a great deal of data on the actual yields in areas reclaimed by the ministry are shown in Appendix D-2-10. It should be noted that those target yields are applicable exclusively to the areas with clayey soils.

According to the target yields, most of the crops are supposed to be able to attain their maximum productivity in the sixth year after leaching has been done. It is noted that the maximum target yield of each crop shown in the table is somewhat higher than the recent national average mostly because of the fertile clayey soils in the areas concerned. Considering other favorable local agricultural conditions, these relatively high target yields will be appropriate.

Consequently, the target yield of the six kinds of crops involoved in the cropping pattern are determined as follows based upon the general target yields:

(i) Rice

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 maximum amount of 7.1 tons/ha in the sixth year. From the sixth year, it will continue to be at this maximum level.

Regarding the fertilization level, urea as a nitrogenous fertilizer will be applied two times during the cultivation period

at a rate of 120 kg/ha respectively. Superphosphate as phosphoric fertilizer will be applied at a rate of 230 kg/ha. However, in the first year, this fertilization level will be reduced by 50% and it will be increased gradually to the normal level by the fourth year. (For details, see Appendix D-2-11)

(ii) Berseem

The maximum 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 target yields.

Regarding the fertilization level, as the first top dressing fertilizer, 240 kg of superphosphate will be applied per ha. For the second and the third top dressing fertilization, 120 kg of superphosphate will be applied per ha respectively. However, this fertilization level will be reduced by 50% in the first year and gradually increased up to the maximum level in the fourth year. (For details, see Appendix D-2-11)

(iii) Cotton

The maximum 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.

With respect to the fertilization level, as a top dressing fertilizer, 180 kg of urea will be applied per ha two times. On the other hand, 240 kg of superphosphate as a basic fertilizer will be applied per ha. Those application rates will be reduced by 50% in the year and gradually increased until the fourth year when the maximum level is attained. (For details, see Appendix D-2-11)

(iv) Wheat

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

As a top dressing fertilizer, 260 kg of urea will be applied per ha. In the first year, this application rate will be reduced by 50% and gradually increased up to the normal rate in the fourth year. (For details, see Appendix D-2-11)

(v) Maize

The 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 1 ton/ha annually until the fourth year.

As a top dressing fertilizer, 180 kg of urea will be applied per ha two times during the cultivation period. This application rate will be reduced by 50% in the first year and increased gradually up to the normal rate in the fourth year.

(vi) Green fodder maize

The target yield of green fodder maize will be 60.0 tons/ha. It will be half as much in the first year.

The fertilization level will be the same as that for maize. (For details, see Appendix D-2-11)

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. Estimated target production of rice straws from the project will be as follows:

	Year					
	1st	2nd	3rd	4th	5th	6th
Production (tons/ha)	0.8	1.7	2.5	4.2	4.2	5.0

Therefore, annual total target production of rice straw with the project during the project life will be as follows:

	Year in the project life			
	3rd	4th	5th	6th
	3,344	10,450	20,900	26,693
Production (tons)	7th	8th	9th	10th
	32,487	36,040	35,831	32,278
	11th	12th		
	33,381	34,485 1/		

Note : For details on computation, see Appendix D-2-12

1/ Maximum total target production

Wheat straws, plant residues and removed plant bodies of cotton and maize as agricultural by-products will be utilized as roughages and fuel depending upon the situation by individual farmers.

6) Total Agricultural Production Expected with the Project

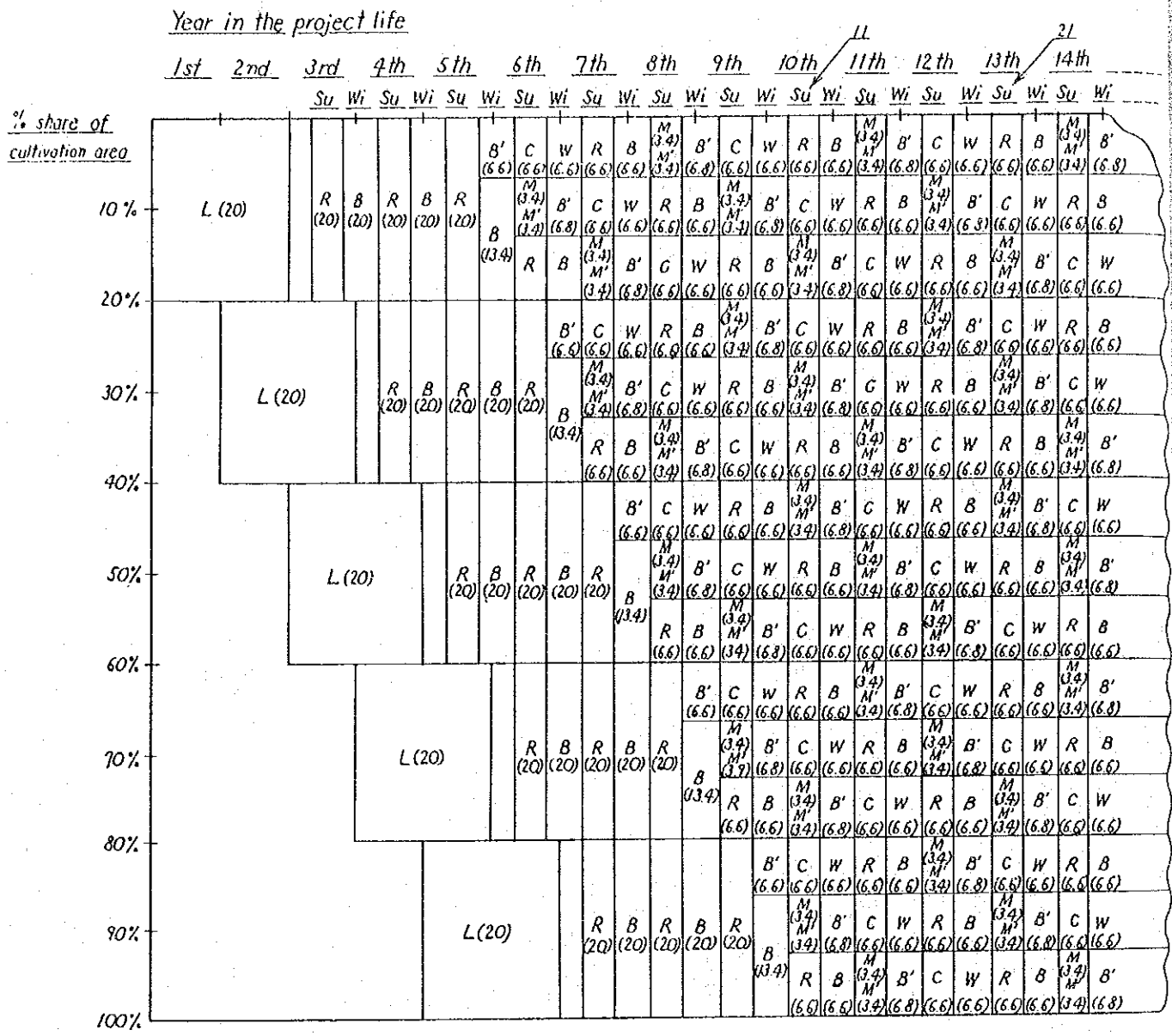
Fig. D-2-3 shows the percentage share of net cultivation area of each crop in the total net cultivation area with the project during the project life.

As the figure indicates, in the summer season in the 10th year, each crop is supposed to start covering the planned cultivation area which is to be fixed in the complete 3-year rotation system with the project. Based on this, the actual net cultivation area of each crop is computed as shown in Table D-2-2.

Total production of each crop expected in each cropping season is specified in Table D-2-3 and Table D-2-4. The maximum total target production of each crop will be expected in the 12th through the 14th year. (For details on computation of target production, see Appendix D-2-12)

Fig. D-2-3

Percentage Share of Cultivation Area by Crops in the Project Life



Legend					
	Su	: summer season	M	:	maize
	Wi	: winter season	M'	:	green fodder maize
	L	: leaching	B	:	full-term berseem
	R	: rice	B'	:	catch-cropping berseem
	C	: cotton	W	:	wheat

Notes : - Number in parentheses shows percentage share of each crop's cultivation area in the total cultivation area.

1/ All farm lands in the project area get into 3-year rotation system in the summer season in the 10th year.

2/ All farm lands in the project area are expected to start providing maximum target yields in the summer season in the 13th year.

Table D-2-2 Cultivation Area by Crops in the Project Life

(Unit: ha)

Crop Items	Year in the Project Life															
	3rd		4th		5th		6th		7th		8th		9th		10th	11th
	Su	Wi	Su	Wi	Su	Wi	Su	Wi	Su	Wi	Su	Wi	Su	Wi	Su	Wi
Rice 1/	4,180.0	-	8,360.0	-	12,540.0	-	12,540.0	-	12,540.0	-	8,360.0	-	4,180.0	-	-	-
Rice 2/	-	-	-	-	-	-	1,379.4	-	2,758.8	-	4,138.2	-	5,517.6	-	6,897.0	-
Full-term berseem	-	4,180.0	-	8,360.0	-	11,160.6	-	12,540.0	-	13,919.4	-	11,118.8	-	8,318.2	-	6,897.0
Catch-cropping berseem	-	-	-	-	-	1,379.4	-	2,800.6	-	4,221.8	-	5,643.0	-	7,064.2	-	7,106.0
Cotton	-	-	-	-	-	-	1,379.4	-	2,758.8	-	4,138.2	-	5,517.6	-	6,897.0	-
Maize	-	-	-	-	-	-	710.6	-	1,421.2	-	2,131.8	-	2,842.4	-	3,553.0	-
Green fodder maize	-	-	-	-	-	-	710.6	-	1,421.2	-	2,131.8	-	2,842.4	-	3,553.0	-
Wheat	-	-	-	-	-	-	-	1,379.4	-	2,758.8	-	4,138.2	-	5,517.6	-	6,897.0
Total	4,180.0	4,180.0	8,360.0	8,360.0	12,540.0	12,540.0	16,720.0	16,720.0	20,900.0	20,900.0	20,900.0	20,900.0	20,900.0	20,900.0	20,900.0	20,900.0

Notes: 1/ By direct seeding method

2/ By transplanting method

Table D-2-3 Total Target Production of Rice, Cotton, Maize & Wheat in the Project Life

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

Note: 1/ Maximum total target production

Table D-2-4 Total Target Production of Berseem and Green Fodder Maize in the Project Life

(Unit: tons)

Crop Items	Year in the Project Life											
	3rd			4th			5th			6th		
		Su[1]	Wi[2]	Wi	Su	Wi	Wi	Su	Wi	Wi	Su	Wi
A) Full-term berseem			19,855	59,565		44,935	134,805		65,239	195,718		78,344
B) Catch-cropping berseem			-	-		-	-		10,001	10,001		23,502
A) + B)			19,855	59,565		44,935	134,805		75,240	205,719		101,846
C) Green fodder maize											21,318	

	7th			8th			9th			10th		
	Wi	Su	Wi	Wi	Su	Wi	Wi	Su	Wi	Wi	Su	Wi
A) Full-term berseem	235,031		94,896	234,690		94,698	284,094		89,274	267,823		38,626
B) Catch-cropping berseem	23,502		40,556	40,556		60,809	60,309		81,061	81,061		91,312
A) + B)	258,533		135,452	325,246		155,507	344,903		170,335	348,884		179,938
C) Green fodder maize		50,453			87,404			130,040			172,676	

	11th			12th			13th			----------
	Wi	Su	Wi	Wi	Su	Wi	Wi	Su		
A) Full-term berseem	265,880		95,179	285,535		98,282	294,847			
B) Catch-cropping berseem	91,312		98,063	98,063		101,261	101,261			
A) + B)	357,192		193,242	383,598		199,543[3]	396,108[3]			----------
C)		193,994			207,495			213,180[3]		

Notes: 1/ Summer season
2/ Winter season
3/ Maximum total target production

7) Livestock Plan

(i) Livestock Breeding in A.R.E.

Statistic data on the trend of livestock foodstuffs in A.R.E. indicate that their consumption has exceeded the production specially in these days, resulting in the necessity to import 50,000 to 60,000 tons of livestock foodstuffs to balance the demand and supply. The consumer's price of edible meat has tended to rise year by year, and the Government was compelled to take a firm attitude against the price escalation of meat in 1980, and prohibited butcher's shops to sell meat for one-month period. These facts suggest that it is an urgent necessity to increase the domestic production of edible meat to stabilize the peoples' livelihood. Taking into account the above-mentioned food situation in A.R.E., it is proposed to strengthen the livestock breeding as a part of the agricultural development under the Project.

(ii) Domestic Animal to be Selected for the Livestock Plan

A.R.E. imported 27,000 tons of chicken and 34,000 tons of beef as of the year 1979. Specially, the shortage of beef has been conspicuous. Therefore, beef cattle has been selected as the domestic animal to be raised in the Project Area.

(iii) Beef Cattle to be Raised

a) Production Capacity of Forage Crops in the Project Area

The proposed cropping pattern and cropping areas suggest that the Project Area could produce the following quantity of forage crops:

Production Capacity of Forage Crops

	Cropping Area(ha)	Yield per ha(ton/ha)	Yield (ton)	Nutrients*/ per Unit(%)	Production of*/ Nutrients(ton)
Berseem for four times harvesting	6,897	57.0	393,129	13.1	51,500
Berseem for two times harvesting	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)

b) Feed requirement

The feed requirement of beef cattle consisting of 100 head in different growth stages is computed as follows;

Feed Requirement of 100 Beef Cattle

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

c) Beef Cattle Herds to be Raised in the Project Area

The number of cattle herds with the composition shown in the above table capable of growing in the Project Area is computed based on the production capacity of forage crops and the feed requirement of cattle as follows:

Production capacity of T.D.N. ÷ T.D.N. requirement by 100 head of cattle

= 124,602 tons ÷ 141 tons = 884 herds

Therefore, cattle of 88,400 head will be raised in the Project Area. Out of 88,400 head of cattle, the percent in number of calves, raising cattle and grown-up cattle will be 30%, 30% and 40% respectively, that is, calves of 25,520 head, raising cattle of 25,520 head and grown-up cattle of 35,360 head will be raised in the Project Area, accordingly.

(iv) Livestock facilities

In order to raise cattle of 88,400 head, the site and scale of breeding facilities have been determined based on the following basic lines:

a) To utilize the non-agricultural lands for some facilities; and

b) To make an appropriate scale of livestock breeding in each collective livestock center in consideration of the environmental pollution possibly caused by cattle breeding, storage and transportation of feed, prevention of diseases, etc.

c) The intensive breeding of cattle will be practiced in accordance with their growing stages. Calves and raising cattle will be accommodated separately from grown-up cattle.

d) Livestock facilities will roughly consist of a stall and a yard. It will be necessary to secure a space of 3.0 sq.m/head in the stall and that of more than 10 sq.m/head in the yard.

e) Site for livestock facilities

There are four different non-agricultural lands in the southeastern portion of the Project Area which will be out of the irrigation area in the Project. These non-agricultural lands are about 290 ha in total, and are large enough to raise 88,400 head of beef cattle as follows:

$$A = 88,400 \times 13 \text{ sq.m/head} - 115 \text{ ha}$$

where, A : Area required for breeding 88,400 head of beef cattle.

f) Beef cattle to be raised in a livestock center

Beef cattle of 88,400 head in different growth stages will be raised in four livestock centers. Calves and raising cattle will be raised in three livestock centers whereas cattle in the remaining center. In other words, one cattle group consisting of calves of 8,840 head are raising cattle of the same number will be raised in each of the three livestock centers, and the remaining livestock center will be operated exclusively for 35,360 head of grown-up cattle.

g) Facilities within a livestock center

Calves, raising cattle and cattle will be separately provided with a stall and a yard. Feed will be put on a feed rack to be installed along the outer stall. Electric fence will be used for stockage. Further description of the facilities is made in Appendix D-2-13.

(v) Operation and maintenance plan

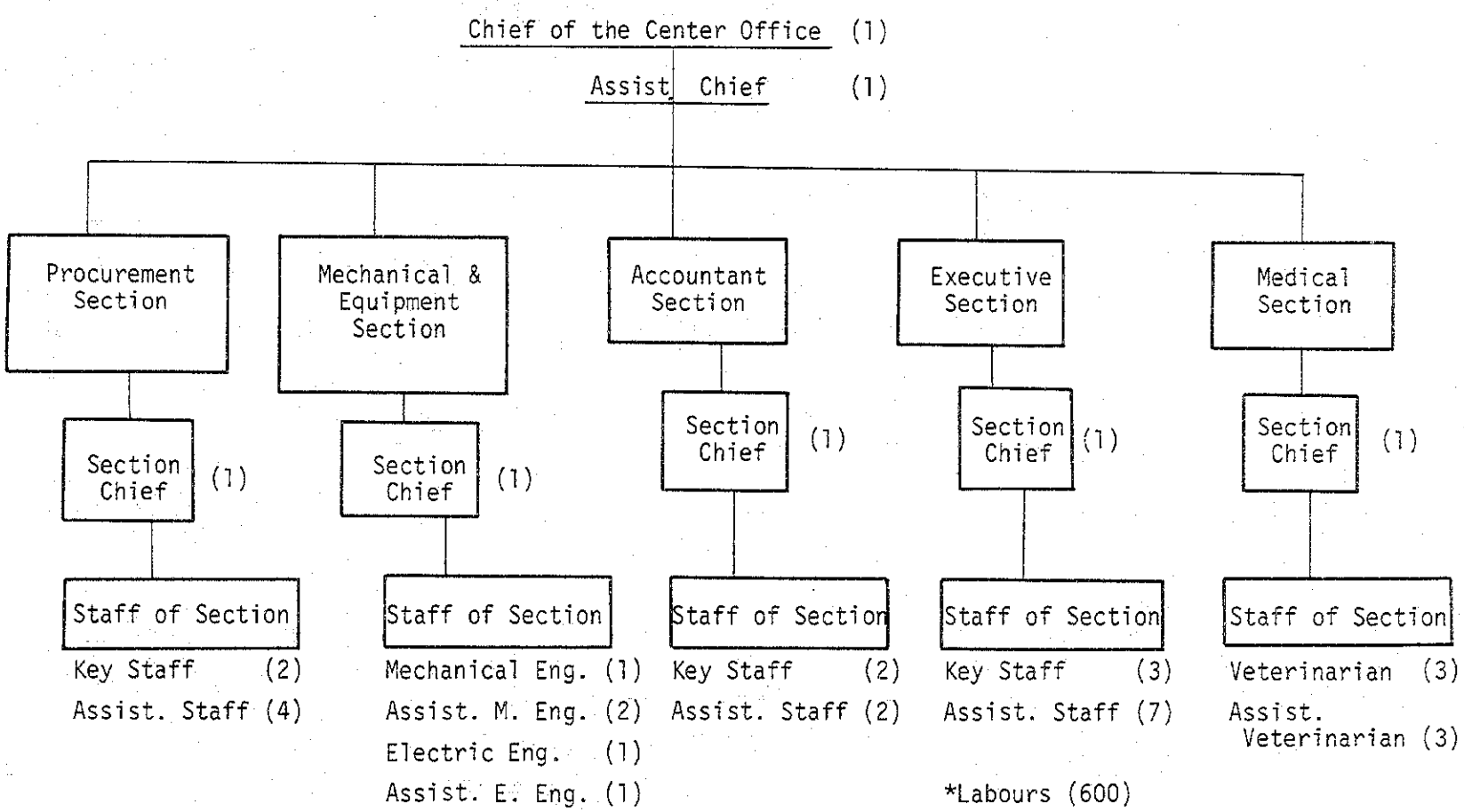
a) Feed and drinking water supply

Mainly berseem of which cultivation has been planned in the Project will be directly purchased from growers in order to furnish to cattle in each livestock center. The annual requirement of roughages computed is about 835,000 tons. Berseem purchased from growers will be stored at a feed storage house to be built within the livestock center areas, and given to cattle based upon a schedule. Necessary facilities for water supply to the livestock centers has been planned as a part of the drinking water supply plan for the Project Area. In computing the drinking water requirement in the livestock center, the drinking water requirement per head amounting to 60 lit/head/day has been employed.

b) Operation and management staff

A livestock center will be equipped with an operation and management office to which a necessary number of operation and maintenance staff will station. The organization chart of this is herein attached. (See Fig. D-2-4)

Fig. D-2-4 ORGANIZATION OF LIVESTOCK CENTER



Note: Number in parentheses shows staff number.

° Operation and management staff

About 600 staff will be required to participate in the operation and management of each livestock center such as watching cattle in yards, stalls and at feed racks, etc., furnishing feed to cattle, treating filthy water and filth, protecting cattle from accidents, etc. This computation for staffing is made on the premise that one staff will take care of 100 head of cattle.

° Special staff

As special staff, one veterinarian will be necessary for cattle of 10,000 head, therefore, two to three veterinarians will be mobilized for one livestock center.

c) Slaughter Plan

About 35,360 head of beef cattle will be raised in the livestock center exclusively for cattle breeding. Therefore, about 100 head of cattle will be butchered every day on an average. A butchery will be installed in the Project Area. This plan will enable the Project Area to produce beef of 9,850 tons/year.

D-2-3 Agro-processing

1) Estimated Amount of Agricultural Produce to be Processed

Most of the agricultural produce as raw materials derived from the project area will be transported to other parts of the country or exported to foreign countries. On the other hand, the rest of the produce as food materials will be consumed by settlers in the project area. Thus, that amount of food materials consumed by the settlers will need to be fully processed exclusively for those settlers in the project area.

The annual amount of wheat, rice and maize consumed by the settlers will be estimated as follows:

i) wheat flour : 250 g[1/] x 13,000 families x 6 persons x 365 days
= 7,100 tons/year

ii) milled rice : 80 g[1/] x 13,000 families x 6 persons x 365 days
= 2,300 tons/year

iii) maize : 110 g[1/] x 13,000 families x 6 persons x 365 days
= 3,100 tons/year

Note: 1/ Average daily consumption per capita in Egypt in 1985 estimated by FAO.

2) Plan of Agro-processing Facilities

Of those three 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 and milled rice which is less consumed than those food materials should be transported into the project area from some other parts of the country close to the project area with less transportation costs.

Thus, 21 sets of a flouring machine with the processing capacity of 0.18 tons/hr will be needed as follows;

(7,100 tons + 3,100 tons)/(0.18 tons/hr x 9 hrs/day x 25 days x 12 months) = 21 sets

21 sets/(6 service villages + 1 central village) = 3 sets

As the above, 3 sets of a flouring machine with the processing capacity of 0.18 tons/hr should be installed at each service village and the central village to provide the settlers at each village with enough amount of food materials with less transportation costs for them. Those machines should be maintained by a mutual association of local farmers such as an Irrigation Board, etc. at each village.

D-2-4. Farming Management Plan

1) Estimated Farm Labour Force Availability with the Project

Since 3.9 feddans of irrigable lands are to be allocated to each farming family in the project area with the total net cultivation area of 49,700 feddans (20,900 ha), approximately 12,740 farming families will be settled during the project implementation.

Based on this number of newly settled families, total potential farm labour force available with the project after all the settlers have moved into the project area will estimated as follows;

i) Skilled farmers : 1 skilled farmer x 12,740 families
= 12,740 skilled farmers .... A

ii) Semi-skilled farmers: 1 semi-skilled farmer x 12,740 families
= 12,740 semi-skilled farmers
= 6,370 skilled farmers ..... B

A + B = 19,000 skilled farmers

iii) Temporary assistant workers : 2 assistant workers x 12,740 families
= 25,480 assistant workers

As the above, since it can be expected that each average skilled farmer has one young man in his family who is supposed to be a semi-skilled farmer capable of providing labour force equivalent to half as much as that of a skilled farmer, the total monthly labour force potentially available with the project will be approximately 19,000 man-months.

In addition, if each average skilled farmer has 2 female family members or children, approximately 25,000 of assistant workers will be available. Each one of those assistant workers would be able to provide labour force equivalent to that of a skilled farmer, when such easy simple works as cotton-picking, plant thinning, etc., are to be done.

2) Future Land-holding System with the Project

The original land distribution policy within the framework of the project has been to provide each farming family with 5 feddans of reclaimed new lands.

There have been two basic systems in which newly reclaimed lands are allocated to prospective farming settlers. In one system, new lands are owned by farmers based upon the private land-ownership system. Another system is to rent new lands to farmers according to the land-tenacy policy. Recently, however, more emphasis has been placed upon the latter system by the government.

Thus, selection of either one of those two systems should be conducted by the authority in the process of settlement implementation considering the economic aspects of the project and the governmental policies concerned.

However, the land-tenacy system would be recommended, since it may be expected to function to prevent the occurrence of undesirable large-scale land-ownership in the project area. In this case, the rental value of reclaimed lands will be determined by the authority in accordance with the degree of agricultural productivity improvement.

Concerning the actual distribution of field-plots among settlers, it is highly recommended that each farming family is supplied with certain number of field-plots spatially separated so that intensive large-scale cultivation of the same kind of crop could be done in a group of many field-plots put together in the same area which belong to many different farmers.

With respect to the actual arrangement of field plots allocated to settlers, as shown in Appendix D-2-14, they will be grouped in three crop belts. Each crop belt consists of 20 plots, each of which is 100 m by 210 m. Each crop belt will be planted to either one of the three summer crops in the summer season in the crop rotation. Those three crops will be rotated in the 3-year rotation system in each crop belt. Each farming

family will be assigned 1.3 feedans of irrigable land in each belt so that 3.9 feddans of irrigable lands all together can be provided to each family.

With this crop belt arrangement, each farming family will be able to cultivate all of the three kinds of summer crops in the same summer season at the same time each crop can be grown in the large crop belt of 42 ha. This type of crop belt arrangement will improve the efficiency of irrigation management, since each tertiary canal is responsible for irrigating only one kind of crop in a cropping season.

Furthermore, this intensive large-scale cultivation of a given crop concerned will make it possible to conduct many kinds of farming operations efficiently and economically.

3) Farming Organization

Basically, 60 farming families who are organizing farming operations in a rotational unit zone (RUZ) should be responsible for managing irrigation operations for the RUZ. (See the organizational chart shown in Appendix D-2-15.)

Activities of 6-7 RUZG's in each small village will be supervised by the Irrigation Group Committee (IGC) at the small village level which is composed of representatives from each RUZ.

Rotational Unit Zone Group (RUZG) should be responsible for the operation and maintenance of the irrigation system including the three tertiary canals associated with the RUZ.

Member farmers of each RUZG will be able to adjust the allocation of labour force for irrigation management to attain the best labour efficiency in irrigation operations. Incidentally, all of the IGC's at the small village level will be united at the Irrigation Board (IB) in each service village. The IB's will be united at the Central Irrigation Board (CIB) at the central village level. The activities of the IB's will be supervised by CIB which is composed of some governmental officers and representatives from the central village.

Any arrangements to maintain the inter-regional irrigation systems will be made through the IB's and CIB. Any informations and governmental notices from the central government regarding irrigation will be conveyed to RUZG's through these boards.

In addition to the fundamental RUZG's function mentioned above, each RUZG should function as a unit organization for various types of farming activities such as the operation and maintenance of farming machines and implements, purchasing of agricultural in-put materials, marketing of agricultural produce, etc.

4) Farm Mechanization Plan

In accordance with the recent governmental policy to further mechanize farming operations in order to reduce high farming costs caused by high labour costs, most of the cultivation operations in the total net cultivation area of 20,900 ha in the proposed crop rotation system will be mechanized.

The proposed large-scale mechanized farming with the project will present an epoch-making mechanized cultivation system which will modernize and further improve the traditional cultivation method.

The specifications of agricultural machinery and implements which will be utilized with the project are shown in Appendix D-2-16. Most of the machinery and implements are powered through the P.T.O. of wheel-type tractors with 90 p.s. The operation efficiency and actual working capacity of each of them are specified in Appendix D-2-2. (For details on operation hours per unit area by crops, see Appendix D-2-17.)

Basically, the maximum possible machinery operation hours per day with the project are supposed to be 8 hours in the proposed cultivation system. However, it should be noted that the maximum possible operation hours of each of the agricultural machinery and implements per day should be expanded up to 10 hours during the month when there is the peak monthly demand for the machinery labour force in order to reduce the total number of the machinery or implements required for the project implementation.

For the farm mechanization systems with the project, two alternatives are proposed for the cultivation of rice and wheat. In the first labour-saving alternative, rice and wheat will be harvested by combines and in the second alternative with lower initial project costs, they will be reaped by farmers with sickles. The economic aspects of those two alternatives associated with the feasibility of the project will be studied.

Incidentally, each RUZG will be responsible for holding agricultural machinery and implements needed for the RUZ.

5) Demand Projection for Farm Labour Force with the Project

Table D-2-5 shows the total and monthly labour force in man-hours required for each crop. It is noticed that the number of labour force man-hours required for each crop grown in the proposed cultivation system is smaller than the current local average ones in Egypt. (For details on monthly labour requirements per unit area by crops, see Appendix D-2-18.)

As indicated in the table however, cotton cultivation still requires intensive labour force especially in September because of the time-consuming cotton-picking works done by farmers.

Table D-2-6 shows the total monthly farm labour requirements in man-months for all crops put together during the project life supposing that one man-month of labour force is equivalent to 200 man-hours. (8 man-hours/day x 25 days = 200 man-hours) However, in reality, this will be 250 man-hours for some farmers in a particular month depending upon the existence of the peak demand for any machinery or implements. (10 man-hours/day x 25 days = 250 man-hours)

Therefore, it should be noted that the actual monthly man-months required for the project implementation would be somewhat less than those shown in the table in some months depending upon the situation.

As specified in the table, the greatest monthly labour force of 26,185 man-months will be required in October in the 7th year in the project life with the second alternative cultivation system in which rice is reaped by farmers with sickles.

Table D-2-5 Labour Requirements by Crops with the Project

Monthly labour requirements per ha (man-hours/ha)

Crop Items	Total	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Rice 1/	629.80	-	-	-	10.27	20.29	321.29	91.61	55.86	40.78	89.70	-	-
Rice 2/	394.58	-	-	-	19.63	54.95	56.80	79.20	55.10	39.90	89.00	-	-
Rice 3/	850.60	-	-	-	10.27	20.29	321.29	91.61	55.86	40.78	310.50	-	-
Rice 4/	615.38	-	-	-	19.63	54.95	56.80	79.20	55.10	39.90	309.80	-	-
Berseem 5/	177.99	20.09	24.09	15.48	19.41	-	-	-	-	8.40	20.33	33.33	36.86
Berseem 6/	125.28	15.47	6.44	-	-	-	-	-	-	11.55	21.67	33.29	36.86
Cotton	1,370.31	-	-	52.58	270.45	324.83	31.62	24.33	172.63	493.87	-	-	-
Wheat 7/	216.39	25.55	34.06	8.76	47.11	42.79	-	-	-	-	-	21.76	36.36
Wheat 8/	431.59	25.55	34.06	8.76	154.71	150.39	-	-	-	-	-	21.76	36.36
Maize	614.27	-	-	-	7.53	49.50	75.49	128.31	87.24	181.16	85.04	-	-
Green fodder maize	324.38	-	-	-	3.22	5.17	41.12	90.86	84.37	99.64	-	-	-

Notes:
1/ Transplanting, harvested by combine
2/ Direct seeding, harvested by combine
3/ Transplanting, reaped with sickle
4/ Direct seeding, reaped with sickle
5/ Full-term berseem
6/ Catch-cropping berseem
7/ Harvested by combine
8/ Reaped with sickle

Table D-2-6 Monthly Total Farm Labour Requirements in the Project Life

(Unit : man-month)

Month	Year in the project life								
	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

However, if harvested by combines, the peak demand for monthly labour force of 24,125 man-months is caused by cotton cultivation. This peak demand will occur in September after complete 3-year rotation has been started in the whole project area. In the complete 3-year rotation system, approximately 2,000-4,000 man-months of labour force will be required in each month during the winter season and approximately, 10,000-24,000 man-months of labour force will be demanded every month during the summer season. However, since this peak demand of 24,000 man-months in September is mainly caused by cotton-picking operations, it can be fulfilled by utilizing the labour force of assistant workers numbering about 20,000.

Thus, it is expected that estimated demand for farm labour force will be met with the project through the project life. However, the seasonal fluctuations of labour force demand for the project implementation will be great. During the winter season, a great deal of extra labour force available in the project area can be utilized for various types of small-scale domestic farm works.