(Tentative Report)

THE FEASIBILITY STUDIES ON RICE MECHANIZATION PILOT PROJECT IN EGYPT

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——— March, 1981 ———

The Feasibility Study Mission dispatched by JICA,
during the period of Jan. 19 - Mar. 16, 1981

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The Feasibility Study on the Rice Mechanization Pilot Project in Egypt

by

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INTRODUCTION

As the river Nile eternally flows, Egypt is contineously growing in her economy, culture, industrial technology, land reclamation, food production and population. However, the growth ratio of population has recently been reported as high as 2.3%, and this is expected to bring a nutritional predicament of Egypt. The Government of Egypt, therefore, has been paying great effort on Food Security and Family planning to cope with future problem in advance.

As the highest priority of the said Food Security Plan, "Agricultural Development with Intesification" has been proposed to fulfill the self-sufficiency of food in Egypt.

Quite recently, in December 1980, the Minister of Foreign Affairs of Japan visited Egypt, and was strongly requested by the Government of Egypt to cooperate with Egypt through Japanese mechanized rice technology, and other advanced agricultural technologies.

In such a situation, the RICE MECHANIZATION PILOT PROJECT will be timely launched in the near future through the mutual agreement between the Ministry of Agriculture of Egypt (MOA) and Japan International Cooperation Agency (JICA).

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The feasibility study mission dispatched by JICA, Jan. - March, 1981

The following report has been drafted by the mission to prepare various practical suggestions, recommendations and proposals to implement the said project, by contacting many related persons and by visiting the proposed area in the heart of Nile Delta during the period of two months from January to March, 1981. The mission hopes that this report gives some clear-cut scope and direction of the project and be easily understood by those officials and persons both in Egypt and Japan. The mission acknowledges sincere cooperations and arrangements made by the Ministry of Agriculture, also appreciates friendly collaboration of three able counterparts and those useful information, data and advices given by Professors, Doctors, Engineers and persons of various institutes and organizations located at various places in Cairo and the Delta.

I. RECENT SITUATION ON FOOD AND AGRICULTURE IN EGYPT

(1) Serious problem of labour shortage in farming area: As already mentioned above, the population in Egypt is rapidly growing (see Fig. 1), and the over-population in rural area has been opressing their daily life. Therefore, great migration to urban area and neibouring countries from rural area has been continuing to get better job and higher wages. Consequently the availability of farming lavour has been decreasing year by year, and the wages are sharply increasing as shown in Fig. 2. Especially in summer season, there are competition of lavour hiring among the crops such as cotton, rice, maize and other crops. Since cotton is the most important crop in Egypt to benefit national income by its export, labour power in the cotton field seems to be prior to other crop fields. The labour shortage in rice production has become one of serious problems of the nation. As seen in Fig. 3, the rice area has been dropping sharply since 1976. If no effort is payed to overcome such problem, it is quite obvious that both area and production of rice may contineously be decreased, and may affect Food Security of Egypt.

(2) Grain production per capita per year*: According to the statistical data on the production and consumption of nutrition products of Egypt, the grain** production per capita per year has generally been stagnant, and the land per capita has been seriously falling off. (see Fig. 1)

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* 200 to 210 kg during the past three decades (world average:330 kg)

** Cereals such as wheat, barley, maiz, sorgum and rice

As to the daily energy supply, 2357 Calory/capita/day is the average of recent three years from 1975 to 1977, whereas the world average is 2500 Calory/capita/day. However, Egyptians' daily energy supply is greatly supported by quite a high amount of imported food crops*. According to an information given by a high-ranked official of Ministry of Agriculture, around 1500 Cal./cap./ day is the realistic data at present.

Such a food situation urgently needs some positive action for grain production to achieve Egyptian food self-sufficiency and security plan.

(3) The strategies for food and agriculture: The Government of Egypt has recently issued the document entitled "CHARACTERISTICS OF FOOD SECURITY PLAN", and is going to provide essential food requirement with prices that coincides with the capabilities of ordinary citizen. The following two directions have been emphasized;

i. Realizing the maximum limit of self-sufficiency through producing the highest amount of local food commodities.

ii. Expansion in production of exporting crops in order to provide sufficient outcome of export return which can be used in import of food crops to cover shortage.

Three posts have been set up in Egyptian Food Security Plan, i.e. Plant Production, Animal Production, and Fish Production to approach towards her self-sufficiency and also to improve people's nutritional deficiency.

(4) The policy in plant production: Some efficient and applicable technologies are requested to intensify present Egyptian agriculture. Efficient technology means new technology which can cover the various problems such as labour shortage, crop yield, income, working system of farmers' organization, marketing development(both domestic and overseas) etc.

To meet the needs of policy of plant production, a/ short-term high yielding variety, b/ expansion of arable land, c/ improvement of poor land, d/ development of irrigation/drainage system, e/ development of plant protection technology, f/ agricultural mechanization, g/ establishment of agricultural mechanization fund, h/ wide spread of small agricultural machineries and equipments among the farmers, i/ establishment of rental system

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* 3 million tons of wheat & flour/year

of agricultural machienery together with machinery service stations j/ development of up-to-date whorkshops to maintain and repair the newly imported or developed agricultural machineries, k/ closer relation between the farmers and agricultural scientists through extension acitivities, l/ development of farmers' cooperatives, and m/ development of storage facilities for both machineries and agricultural products are pointed out as the key items.

II. MAJOR CROPPING PATTERNS IN EGYPT

The focus of this report should be concentrated on the development and establishment of efficient rice producing technology by introducing Japanese small (or middle) agricultural machineries. It is, however, quite necessary to conceive the general cropping patterns in Egypt, because both summer- and winter-crops are partaking Egyptian intensified agriculture through continuous rotation. There is no place for permanent or perennial crops in the Egyptian cropping system by today.

Fig. 4 shows major cropping patterns and proportions of production area by crop. Alternative combination of summer- and winter-crops has been practiced for a long period. The most common rotation is three-year cotton rotation, and another popular rotation is 2-year rotation. Intercropping is also practiced in some area where a secondary crop is grown simultaniously with the main crop. For example, summer onion is grown as a companion crop with cotton, and this is common in southern half of the Delta.

In the northern half of Delta, rice is the main summer crop followed by wheat and legumes. Some 75% of rice among the whole rice production in Egypt is raised in the Northern Delta Rice Zone.

III. RECENT SITUATION ON RICE CULTIVATION IN EGYPT

(1) Decrease in Area and Production : Rice is more beneficial crop for both farmers and the Country than other summer crops. Rice is one of the most important crops together with cotton. However, as mentioned above, recent severe labour situation in those rice producing area has been strongly affecting their farming conditions. As shown in Fig.5, the rice area in the Northern Delta Rice Zone has been decreasing, and the rice production has also been stagnant or gradually decreasing(see Fig.6) because of labour shortage.

It is needless to say that Egyptian rice farming is already under the heavy pressur of necessity of mechanization.

(2) Transitional stage from manual cropping to mechanized croppins: Quite recently, harvesting of rice has been done by some of Europian combines which were originally made for upland crops. However, the results of these big combines seemed not to be sufficient. The reason might be derived from such a factors as i/ too heavy and too wide to bring through their narrow farm road, ii/ relatively high yield loss, iii/ decrease of straw recycling through scrambled threshing, and iv/ uncertainty of economical solution etc.

One of the problems in the case of manual transplanting is that each hill is randomly transplanted with too many seedlings by part-time labourers, and this causes overpopulation of stems and leaves in an unit area. However, such overtransplanting per hill can not be stopped, no matter how loudly instruction is given to the labourers. Although the mission does not inspect the ecological condition of rice plants in the field, it is obvious that lodging is caused by such overpopulation (or overgrowth) and elongated stems bearing long and heavy panicles.

Several high-ranked officials of the Ministry of Agriculture have recently visited Japan, and they have studied and observed Japanese mechanized rice cultivation technology. They might hope that, if Japanese rice technology were transferred to Egypt, those difficulties in Egyptian rice farming would be quickly solved. Therefore, new rice technology by using Japanese small agricultural machineries will soon be introduced, and shall be widely spreaded all over the Northern Delta Rice Zone in the near future. The coming several years can be called as the transitional stage of Egyptian rice technology from the old to the new and prosperous.

(3) Short-grained and non-sticky rice varieties: Egyptian prefer the short, non-sticky and transluscent rice grains. Therefore, the emphasis has to be payed on the production of such varieties even in the future projects. This effort will directly contribute towards their FOOD SECURITY PLAN. Fortunately, all the Japanese high yielding rice varieties are short-grained and their shattering habits are much tighter than those of long-grained varieties. These characteristics are important to achieve the Rice Mechanization Pilot Project which

will be favoured by all Egyptians and without big harvest-losses.

(4) Difficulties in Egyptian rice production: Generally speaking, their common rice varieties are Nahda, Giza 171, Giza 172 and other short-grained long-culmed japonica varieties. If Egyptian farmers would stick to these long-culmed rice, they might be subjected to the problems of lodging and big harvest-losses. It has been proved that the panicle-number type varieties with high tillering accompanied with erect leaves bring much higher yields than the panicle-weight type with tall stem and less tillers. The mission has found that the farmers pay their attention not only to the grain yield but also to the straw yields. The hunter who chases after two rabbits can get none of them. Top attention has to be payed to the purpose of how to get the maximum grain yield with higher quality rather than the selling of rice straw to some paper mills and other recycling system.

Another difficulty is the intermixture of rusty kernels, and the ratio seems to be rapidly raised year by year. The distribution of seeds itself contains this fatal problem, and renewed seed multiplication from the beginning at the MOA level should be done. Such intermixture of rusty grain should be vanished away as soon as possible, to gain good reputation of high qualitied Egyptian rice.

As to the quality of Egyptian rice, such kernels as milky-white rice, white-core rice, white-belley rice and broken rice should also be eliminated. Leaf area index(LAI) and the number of spikelet per unit area should be taken into consideration in the future rice technology together with fertilizing technology to obtain well ripened grains.

IV. ENVIRONMENTAL CONDITIONS AROUND EGYPTIAN RICE PRODUCTION

(1) Abundant light, sufficient water and optimum temperature: Rice is originally the tropical plant, and can grow well even under flooded condition, whereas ordinary upland crops suffer from submerged condition. As far as the japonica rice are concerned, the seeds can germinate above 12°C, the plants grow quite well at 31°C and are tolerable up to 35°C, and heat damage takes place at hot temperature above 36°C. Fortunately, the summer temperature is

less than 35°C on the Northern Delta Rice Zone. The Nile promises its constant water supply to those paddy fields in the Delta during the crop season. The intensity of solar irradiation is very high (ca. 80,000 to 150,000lux), and this is the great merit for the activation of photosynthesis of rice leaves during whole season.

(2) Quality of irrigation water: All the crops in Egypt rely upon the raw water of the Nile as well as Egyptians and their animals. Table 1 gives some background information on the irrigation water at the Delta. The raw water of the Nile is slightly basic and contains several salts and minerals, but there would be no big problem in rice cultivation if irrigation is sufficiently practised and drained well to leach salts from the soil, although the range of each characteristic of water might be changed to some extent.

(3) Heavy alluvial soil: Briefly speaking, the soil in the Delta can be called heavy alluvial soil (scientifically: Eutric Fluvisol). The depth of such a soil is supposed to be around 10 meters in the Delta, and 8 meters in the Nile Valley. Soils in both Delta and Valley are fertile, but very heavy when they are wet and puddled. When they are dry, the soil hardness gauge indicated infinitive, i.e., soils are as hard as rock unless organic compost or other soil conditioning materials are supplied together with chemical fertilizers.

Soils can be classified as Class 1* and Class 2** based on FAO, GUIDELINES FOR SOIL PROFILE DESCRIPTION, as far as the presence of salt or alkali is concerned. Texture is "Clay". (refer to Annex 3)

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* Class 1: Soils slightly affected by salt or alkali. The growth of sensitive crops is inhibited but that of salt-torelant may not be.

** Class2: Soils moderately affected by salt of alkali. Crop growth is inhibited and no crop does well.

Approximate Limits of Salinity Classes

Class 0:	Free, Conductivity of saturation extract =	0-4 millimhos/cm^2
Class 1:	Slightly affected,	4-8
Class 2:	Moderately affected,	8-15
Class 3:	Strongly affected,	above 15

(4) Pests, diseases and weeds in Egyptian rice fields:

The following pests such as stem borer (Chilo agamemnon), blood worm (Dipthera chironomus sp.), rice-field fly (Ephydra macellaria Egga.), rice leaf-miner (Hydrellia griseola Fallen), rice root weevil (Picia affierii Pic.), lesser grain-borer (Rhyzopertha dominica Fallen), grain weevil (Calandra oryzae lin.), long-horned grasshopper (Homorocorphus nitidulus Scop), purple-lined borer (Chilo simplex Butl.) etc. have been listed as insects for rice plant or rice grain. However, the stem borer (Chilo agamemnon) is the major rice pest which originally attacked maize and sugarcane. Damages by other insects seem to be negligible.

The most serious rice disease in Egypt is blast(Piricularia oryzae). Wide spread cultivation of Nahda, blast-resistnt variety, has been keeping the minimum loss during the last twenty years. Low humidity in Egypt controls the spread of fungal disease.

The weed population in the established rice region consists of 80% Cyperus difformis L., 15% Echinochloa crus-galli, and 5% other weeds such as cyperus esculentus and Amania sp. In the Northern Delta Rice Zone, Cyperus difformis and Echinochloa seem to be major weeds to be controlled.

Attention should be payed to the native parasite, BILHARZIA, during the rice season. (see Annex 4)

V. PRODUCTION COST OF RICE PER FEDDAN

As already stated in previous chapter, the wages are growing rapidly, and it is expected to be around 200 Piasters per day in 1981. The following figures are a brief economics of rice production by manual procedures as of 1980 (see Table 2).

In Egypt, every farmer is obliged to offer 1.5ton/feddan to his government at the set price of 75LE/ton. As to other rice grains, he can sell at around 100LE/ton or use for domestic consumption. However, as Table 2 shows, he can not have big merit no longer from rice production unless he could reduce labour costs or gets abnormally high yields. This fact also affects the area and production of rice in Northern Delta.

VI. RICE CULTIVATION TECHNOLOGY AT PRESENT IN EGYPT AS OF 1980

(1) Land preparation: Since the rice is one of crop items of rotation farming, winter crops such as wheat and clover are growing prior to the rice season. Therefore, land preparation can be done after the winter crops. Differing from Asian way, rice land is prepared in dry condition by using chisel plow and other plowing machinery. In other words, there is no puddling procedure together with the irrigated water.

(2) Seedbed preparation: The seedbeds are prepared immediately after the harvest of winter crops (April/May). One-feddan seedbed generally can cover 6 to 8 feddans by transplanting of seedlings. The seedbed usually needs one hand weeding, and grow the seedlings ready-to-transplant in 35-40 days from the sowing date.

(3) Popular varieties: Generally speaking, majority of Egyptian rice varieties are japonica-type which has short and transluscent grains. Nahda has been the dominant variety, first released 1954. Nahda was highly resistant to blast in the beginning, but it has been showing some signs of susceptibility recently. GIZA 171, GIZA 172, GIZA 180, and GIZA 159 are other varieties cultivated today. GIZA 171 is the most popular variety at present, and is planted about 40% of whole rice area. GIZA 159 is a salinity tolerant variety, and is grown in limited area along the Mediterranean Cost where soil salinity is relatively high. Quite recently, since 1975, IR 579-48 has been grown for the future export purpose, but not for the domestic consumption.

(4) Transplanting and Direct-sowing: There are two ways of rice cultivation in Egypt, i. e. Transplanting (60%) and direct-sowing (40%). Since the cultivation by transplanting brings much higher yield than the other, it has been conventional way by today. Number of seedlings per hill is usually exceeded, and cause overpopulation and lodging in later growth stage. However, as mentioned above, labour shortage problem is now restricting the expansion of rice area by transplanting by hand.

(5) Weeding: Some 90% of weeding is done by hand in both transplanted

and direct-sown rice fields once or twice. Left over herbicides for cotton fields are used sometime, but efficient weeding by chemicals may quickly be developed in the near future.

(6) Irrigation and drainage: Generally speaking, irrigation canals are well established in the Delta. Therefore, irrigation is easily done almost everywhere by pump or animal-driven SAKYA. The common irrigation/drainage practice is either 7-day-wet/7-day-dry or 4-day-wet/4-day-dry, although there are little modefication depend on season and locality.

As to the drainage, national project for soil amelioration has been going on in the Delta, and some area were already settled concrete pipe lines for better drainage. The concrete pipes are opened at the bank of main drainage canals.

(7) Application of fertilizers: Fertilizer consumption in Egypt has been growing, as shown in Fig. 7, and especially the application of N-fertilizer has been greatly increased during the last three decades. On the other hand, K-fertilizers' consumption keeps horizontal level and P-fertilizers show their gradual increase, because of high contents of potassium and phosphorus in Egyptian soils. In the case of rice production, 30kg of N-fertilizer per feddan are applied after the winter cropping of clover, and 40kg of N-fertilizers are fed to the field after wheat harvest. As to P-fertilizers, 15kg(P_2O_5) per feddan are applied in the form of monophosphate or superphosphate. No K-fertilizer is applied, but Zn has recently been dressing the soils by making of imput of 20kg per feddan to reduce the physiological disorder of etiolation which might be caused by alkaline soil.

(8) Harvesting and threshing: When the rice spikelets are ripened (October/November), each hill is cut by sickle manually, and the straws are bunched into a proper size of bundle. The panicles are dried in the open air for few days, and are threshed on a floor by driving a tractor repeatedly on the straw layers.

(9) Winnowing of paddy grains: The threshed paddy grains were collected and winnowed by a simple winnower with motor. Light dust are separated, but sand or small gravel are not eliminated from the

winnowed paddy grains. Broken grains also remain together with good grains.

(10) Percentage of ripened grains produced in 1980:

It is necessary to know the ripening percentage of the rice grains produced every year to improve the quality of rice and cultivation technology. The mission has tested the percentage of ripened grains produced in 1980 by a simple method* as follows.

Salt water which has the specific gravity of 1.1 is prepared by dissolving salt into tapwater until a chicken egg is slightly floated and shows its shell surface at the salt water level, as shown in the following picture.

Then the same amount of rice seeds of both GIZA 171** & GIZA** were dumped into the glasses of salt water, and were stired untill the whole seeds were wet. The well ripened seeds were sunk, and imcomplete grains were floated. The percentage of ripened grains can be obtained by the next form:

$$\frac{\text{Number of Sunk Grains}}{\text{Total Number of Grains}} \times 100$$

Variety	Number of sunk grains	Number of floated grains	Total number	% of ripened grained
GIZA 171	510	215	725	70.35
GIZA 172	500	240	740	67.57

Note: * Japanese farmers have been practicing this method to select good seeds before their seeding.

** The grains(unhusked seeds) were supplied by the Seeds Testing Department, General Agricultural Authority, Giza. These seeds were already winnowed and cleaned. Therefore, the real percentage of ripened grain would be lower than the data written above.

VII. SUGGESTIONS, RECOMMENDATIONS AND PROPOSALS

Recognizing such recent situation on food/agriculture and conditions on rice cultivation in Egypt as mentioned above, the mission has prepared the following suggestions, recommendations and proposals in connection with the RICE MECHANIZATION PILOT PROJECT which will soon be launched:

(1) Project Site and Area; The mission was lead to the next two proposed sites, i.e., Kafr Difriya (State Farm) and Mehalet El-Kasab(Farmers' Cooperative Farm) in Kafr El Sheikh City (refer to the attached maps). The former is detached land and will be easy to build some facilities, and the latter seems to be difficult to obtain the vacant area for facility construction. However, as far as soil and irrigation conditions are concerned, the latter site is much better than the former site, as shown in the following picture. The drainage condition seems to be much better in the state Farm. If the land for facility complex were sufficiently provided at the nearest place to the JAPAN RICE FARM (tentative name), the mission prefers Mehalet El Kasab Village because of the following reasons.

Comparison of soils collected at Kafr Difiria and Mehalet El Kasab a/ According to one of mission members' studies and observations in East European countries, the productivity of state farm (kolkhoz) is generally lower than cooperative farm. The highest productivity can be seen only in provate farm. This trend seems to be true even in Egypt. b/ Reasonable benefitting system among the farmers is one of the most important factor to achieve the RICE MECHANIZATION PILOT PROJECT. Therefore, the farmers (cooperative members) will solve by themselves such problems as planting order, lovour-sharing, machine-sharing, evaluation of lavour quantity and quality, premium service to the machine operator for his extra work, mutual management and keeping of agricultural machineries, agreeable benefit distribution among the farmers etc. The purpose of this project is not only to show how to raise rice by machine, but also to form some output for infinitive possibility of expansion of the beneficial rice technology. c/ The soil condition at Mehalet El Kasab will supply greater advantage for quick success of the project with high yield. Precise soil test and analysis will be done at the National Institute of Agricultural Sciences at Tsukuba Science City, Japan (refer to the tentative Field Soil Description Sheet, Annex 3). D/ Quantity and quality of water seems to be good enough at Mehalet El Kasab. e/ Irrigation can be easily done in short time. f/ Convenience for experts' staying and friendly contact with the farmers will be better at Mehalet El Kasab. etc.

The area of JAPAN RICE FARM should be one hundred feddans as the demonstration farm of Japanese rice technology by small agricultural machineries.

(2) Facilities; The following facility complex preferred to be built and functioned in the nearest future by the project's implementation.

a/ Administration Building including director's room, deputy director's room, experts' room, meeting rooms, VIP reception room, general staff room etc.

b/ Auditorium with capacity of some 500 farmers' attendance, equipped with 16 mm movie or color-slide-projection booth, screen, blind curtains, ventilator, diesel engine dynamo etc.

c/ Workers' building for job assignment and instruction

d/ Guest House with lounge, dining room, reading room, bedrooms etc.

e/ Seed Storage equipped with air-conditioner and sealing room

f/ Garage and Moter Pool for cars, tracks, agricultural machineries

g/ Working Building for various preparation of rice cultivation

h/ Stock Rooms for fertilizers, agricultural chemicals, spare parts, fuel & oils and other materials

i/ Workshop for the maintenance and repairs of machines and tools

j/ Glasshouses and Net-houses for raising and protecting the rice seedings and other summer and winter crops' nursery use

k/ Lath-houses for initial growth of germinated seeds and ornamental plants to beautify the facility complex in the farm

l/ Water Tower and Pump to supply water to the facilities and the nursery area

m/ Reservoir (with cover) as the pool of emergency water needs

(3) Machineries and Equipments; Whole the series of agricultural machineries and equipments will be provided to achieve the RICE MECHANIZATION PILOT PROJECT. The list of necessary machineries and equipments is attached as Annex 1.

(4) Materials and agricultural chemicals; As seen in Annex 2, all the materials and agricultural chemicals which will be needed to achieve the project without fail will be provided sufficiently.

According to a recent information, the Ministry of Agriculture of Egypt purchased 50 kinds of agricultural chemical for 1979/80 season, but none of them was aimed for the protection of rice plants. Some leftover chemicals at cotton field have been applied to the rice field. Attention especially for raising healthy seedlings and avoiding the damages by blast and stem borer should be payed. The most efficient and economic application system of agricultural chemicals during the whole rice season should be established by selecting proper materials.

(5) Varieties match with mechanized rice technology; Majority of Japanese rice varieties at present were bred to fit the mechanized rice technology. As already mentioned above, some good HYV (high yielding variety) seeds must be used together with the use of small agricultural machineries. Panicle number type is preferable to panicle weight type. Therefore, the following Japanese varieties will be introduced to the farm:

- REIMEI = a mutant derived by Co^{60} irradiation, early maturing,
- NIHONBARE = widely spread dominant variety, medium maturing,
- REIHO = dominant variety in southern Japan, semi-medium maturing

The mission hopes that every variety brings some good results without any difficulty in nursing, transplanting, growing, ripening and harvesting in the new rice field at Kafr El Sheikh. Precise growth survey and recording should be done every year.

(6) Cropping plan in the farm; The field of one hundred feddans will be divided into three blocks as follows.

- Block A: 50 feddans for mechanized transplanting of rice
- Block B: 30 feddans for direct sowing of rice
- Block C: 20 feddans for other summer crops

For the second year cropping, Block A can be shifted as B and C, and Blocks B and C can be converted into Block A.

Some Egyptian varieties such as Nahda, Giza 171 and Giza 172 will be transplanted as the control plots together with those 3 varieties mentioned above.

(7) Key procedures in mechanized rice technology;

a/ Nursing procedure, i.e. soaking of seeds into disinfectant, soil preparation for nursery beds by adjusting pH and mixing with fertilizer and soil disinfectant, sowing of pre-germinated seeds on the plastic nursery trays by sowing plant, keeping of seeded nursery trays within plastic house or glasshouse, taking care of emerged seedlings by checking temperature and soil moisture. These procedures take about 4 to 5 weeks.

b/ Land preparation at rice field, i.e. fertilizer and manure application as the basal dose, plowing, puddling and leveling under irrigated condition. The use of cage-wheel and rotary tiller is important in puddling operation. This procedure should be done at least one day before transplanting. Shallow irrigation (few cm) is recommended for successful transplanting by machine.

c/ Mechanical transplanting, i.e. 6-raw riding type transplanter can cover 3 feddans per day per one machine. Some 500 trays of rice seedling mattress will be needed for 3-feddan transplanting.

d/ Application of herbicides. Timely application of herbicides brings efficient result of weeding. Generally herbicides are applied after the rooting of the transplanted seedlings, say 1 week to 10 days after transplanting.

e/ Pest and disease control. As already mentioned above, the main pest is stem borer (Chilo agamemnon) and the main disease is blast (Piricularia oryzae) in Egyptian rice field. Therefore, preventive actions against such pest and disease should be performed. Dusting either in early morning or late evening is effective because of inversion layer of the air.

f/ Split application of nitrogen. A lump application of fertilizer seems to be related with the lodging of Egyptian rice plants. Total amount of nitrogen per unit area should be split as basal dose and top dressing. Fertilizer application technology has to be combined with the physiological stage and the color grade of leaves of rice population in the field. Fertilizer tolerability of each variety has also to be taken into consideration.

g/ Harvesting by either binder or combine. There is a proper time of harvesting, that is about 40 days after heading. Too early or too late harvesting decreases the quality of rice. For example, 4-raw Japanese combine can harvest 1 feddan per hour at maximum speed and 0.5 feddan at minimum speed. The threshed grains can be sacked along with the harvesting function. Plastic net sack would be convenient for drying the threshed grains.

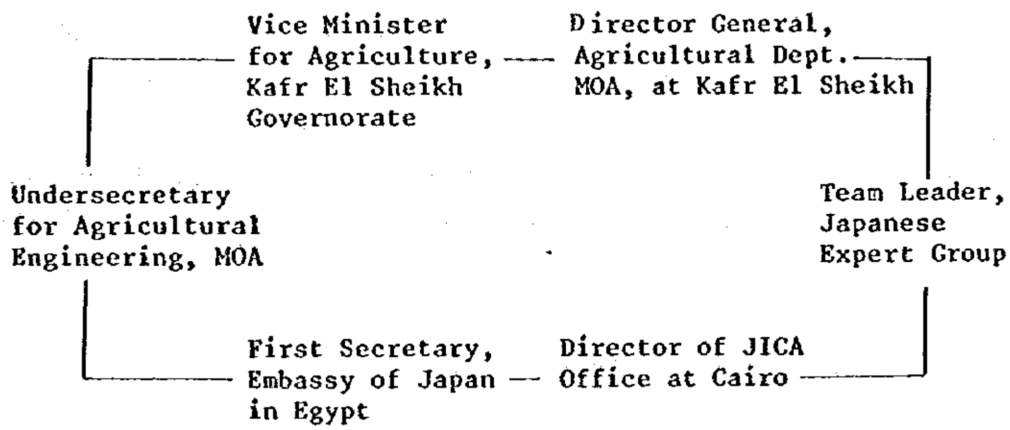
As to the detailed procedures, see Annex 5.

(8) Running Costs of Japan Rice Farm;

(Shall be provided by the Ministry of Agriculture, Egypt)

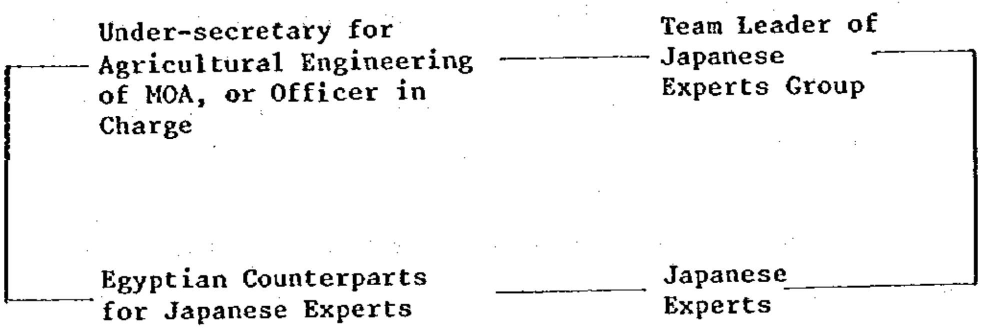
(9) Steering Committee of RICE MECHANIZATION PILOT PROJECT;

The mission would like to propose the following organization to lead the project directly to its goal.



The Committee can be convened whenever some considerations or discussions on R.M.P. (abbreviation of the project) are requested. Any important matter should be discussed and mutually understood through this Committee meeting.

(10) Executive Committee of R.M.P.; The mission expects that Executive Committee would be organized, and periodical meeting can be held to promote various functions in R.M.P. either at Cairo or at the project site. The committee members will be as follows.



(11) <u>Office of R.M.P.</u>; The mission hopes that the office of R.M.P. would be opened at a proper floor of FAO Building where various foreign project offices are located. The similar office will be established in the administration Building at the project site in Kafr El Sheikh.

(12) <u>Working Pattern of Japanese Experts</u>; It takes more than two and half hours by car to get project site from Cairo, and it is rather difficult to attend daily. Therefore, the mission expects that half of the week can be devoted to the administrative work and various liaisoning activities in Cairo, and other half can be payed to the managing, instruction, surveying, contacting with the farmers and other various work items at project site. Of course this general working pattern will be modified depend on the seasonal farm work or unexpected business. However, it is preferred to remain some members including Egyptian counterparts at the project site always by relief system among the experts and the counterparts.

(13) Time Schedule for R.M.P.: Although the implementation of this project has been delayed, the following items should be done.

Month(s)/year	Item of Action	Remark
May-June/1981	Arrival of Final Mission	R/D Signing and Survey at Project Site in operation
Sept.-Oct./1981	Arrival of Japanese Experts Implementation of R.M.P.	Survey on harvest
	Arrival of Machineries and Equipments, seeds etc.	Preparation for functioning
Summer/'81 to Winter/'82	Construction of facilities, Forming of project site	Acted by Egyptian side
February/1982	Preparation of soils for nursery bed for 50 fed.	pH should be 5.5-6 Zn might be added
March/1982	Preparation of seeds, Sowing practice by seeding plant	
April/1982	Sowing, Nursing of Seedlings and protection against birds or rats	Plastic House or Net-house may be needed
May/ 1982	Plowing, Application of fertilizers and herbicides. Transplanting by machine after puddling by machine.	Irrigation water should be kept as shallow as possible (2-3cm) during transplanting. Demonstration
June-Aug./'82	Control of rice fields: Split application of N, Growth survey, water control etc.	
Sept./1982	Harvesting by small combine of early variety rice	Demonstration
Oct./1982	Harvesting by small combine or binder of medium variety	Demonstration
Nov./1982	Harvest by small combine and binder. Threshing by thresher. Husking and Polishing	Demonstration
Dec./1982	Collection of seeds and keeping for next season, 1983	Air-conditioned Seed storage room
Jan./1983	Consultation on Egyptian counterparts' training in Japan	JICA Headquarters and various institutes

and so forth

VIII. SUMMARY

Japan International Cooperation Agency (JICA) dispatched the preliminary survey mission to Egypt in autumn of 1979 to make a follow up action for the request made by Egyptian Government. The report on preliminary survey on Rice Mechanization Pilot Project in Egypt (in Japanese) was issued by JICA in March 1980. After a long rag period, JICA requested the Ministry of Agriculture, Forestry and Fisheries to nominate the mission members to make the feasibility studies on the said project so that they can prepare for the implementation of R.M.P.

The feasibility study mission has been trying hard with the cooperation and collaboration of various MOA staff. The mission regrets that the studies had to be done during the off season of rice. However, the basic factors affecting the recent Egyptian rice production has generally been studied and the practical plan for R.M.P. has been designed by the mission.

Taking those various suggestions and requests given by Egyptian officials into consideration, the mission would like to summarize as follows:

(1) R/D signing is urgently requested. The final mission for R/D signing and practical survey at project site in operational season (May-June 1981) has to be dispatched to reach mutual agreement between MOA and JICA.

(2) The location of project site has been tentatively selected, but the detailed conditions requested by the mission has to be adjusted by MOA side before the arrival of R/D final mission.

(3) Agricultural machineries, equipments, materials, agricultural chemicals and other needed items have been fully listed up to the maximum limit.

(4) Trainee candidates shall be qualified by JICA Headquarters based on the personal history and other attached documents.

(5) Japanese experts group for R.M.P. will be dispatched sometime in autumn 1981, and will be preparing for the start of R.M.P.

(6) No restriction or disturbance is welcome in R.M.P. to reach the goal of R.M.P. as quickly as possible.

(7) The period of R.M.P. is expected for 5 years starting from 1982 upto 1986. Phase I: introductory period (1982 - 1984), Phase II: establishing period (1985 - 1986).

The mission wishes the fruitful success in R.M.P. and rich blessing towards Egyptian farmers through R.M.P.

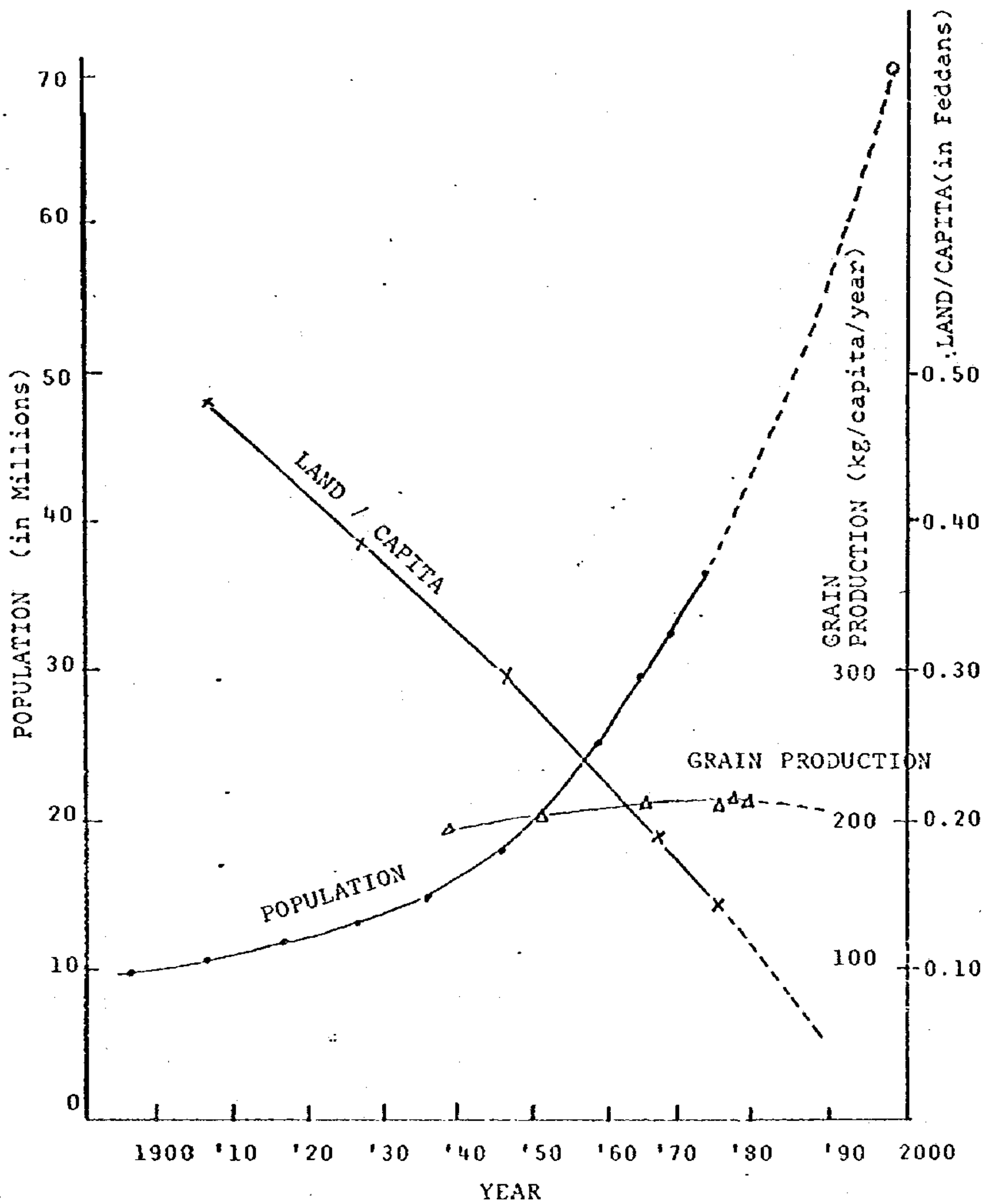


Fig. 1 Trend of Population Growth, Land/Capita Ratio, and Grain Production/Capita/Year in Egypt

Source: M.M.Al Sayyad, EGYPT, World Atlas of Agriculture Vol.1
H.A.El-Tobgy, Contemporary Egyptian Agriculture, 1976
SANYU CONSULTANTS Report, May 1980

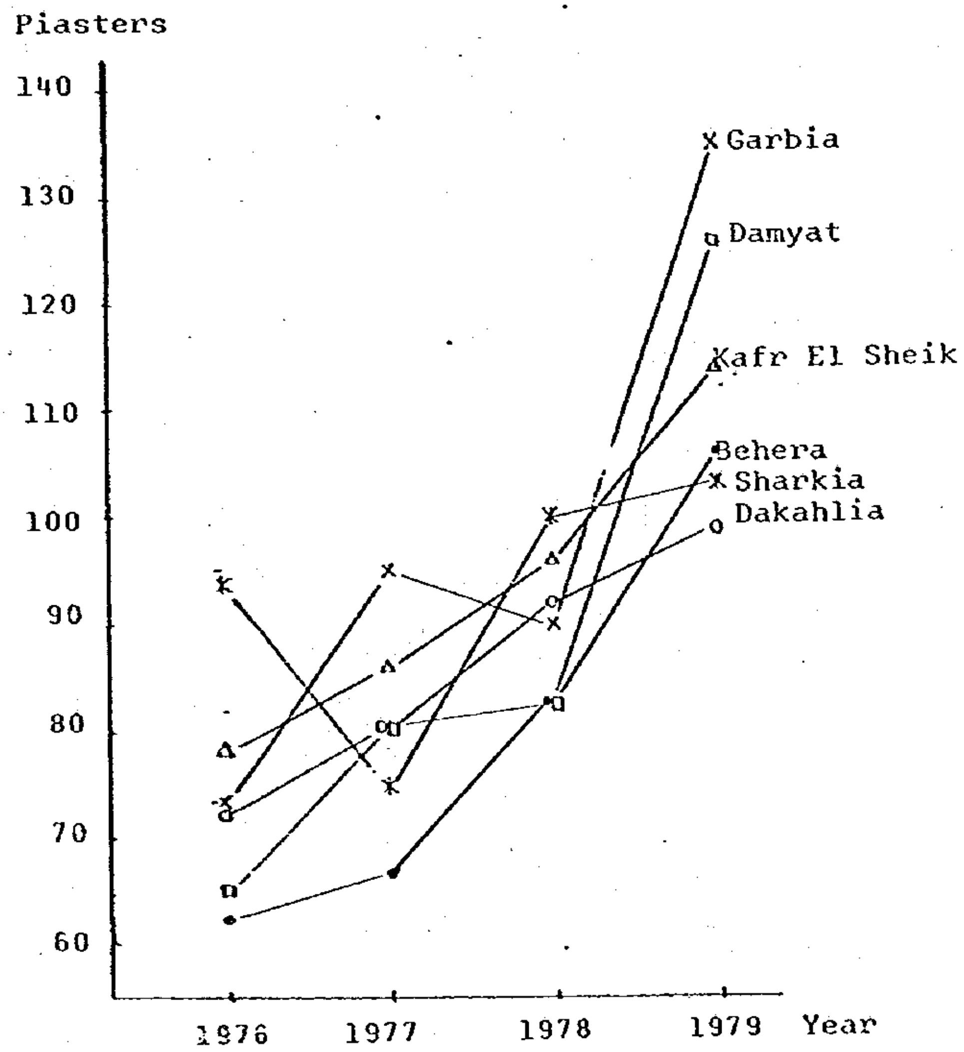


Fig. 2 Recent Trend of Average Daily Wages in Rice Producing Governorates in the Northern Delta

Source: Agricultural Economics Dept., MOA, 1980

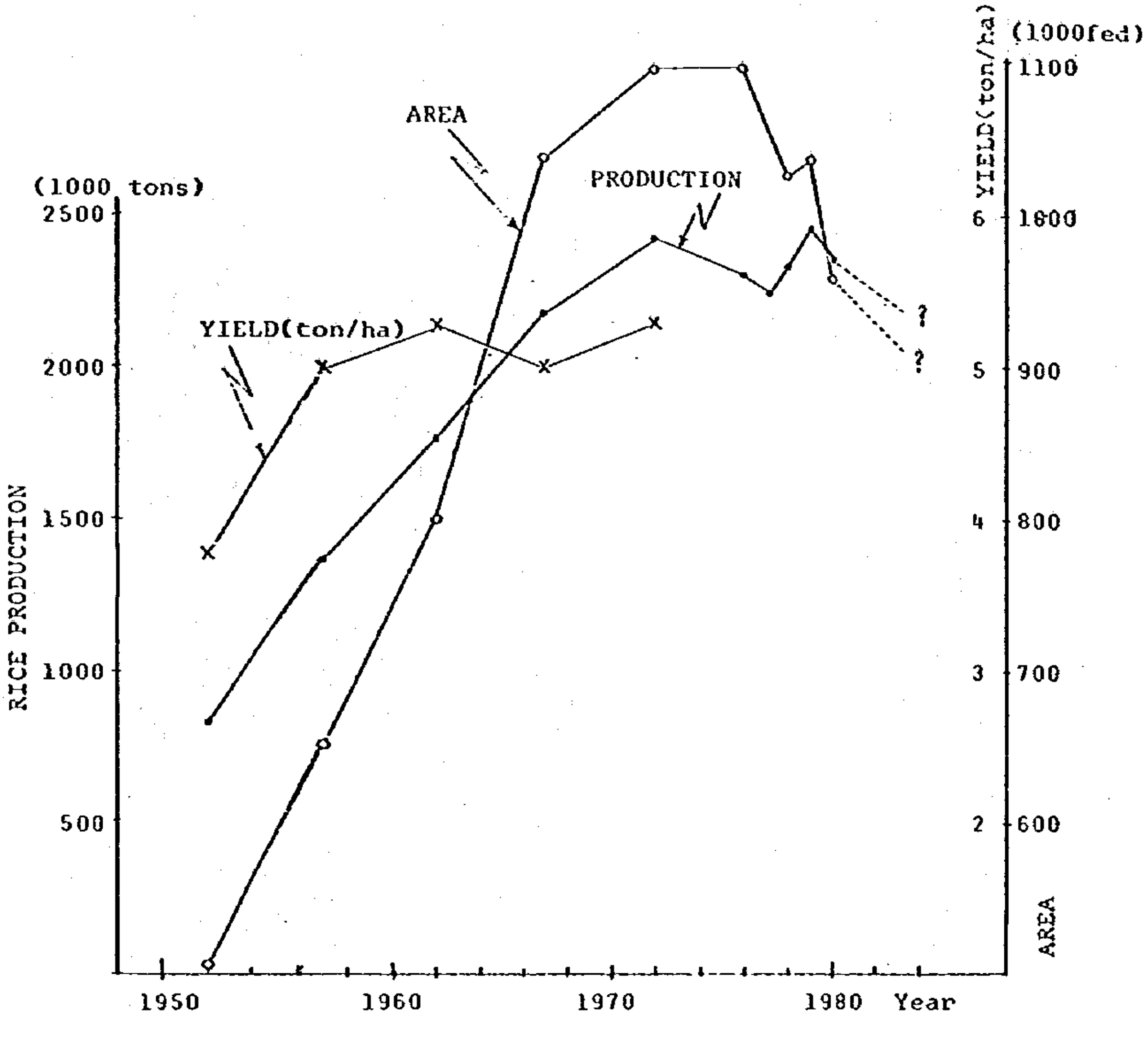


Fig. 3 Trend of Rice Production, Area, Paddy Yield per Hectare in Egypt

Source: H.A.El-Tobgy, Contemporary Egyptian Agriculture, 1976
Agricultural Economics Dept., MOA, 1980

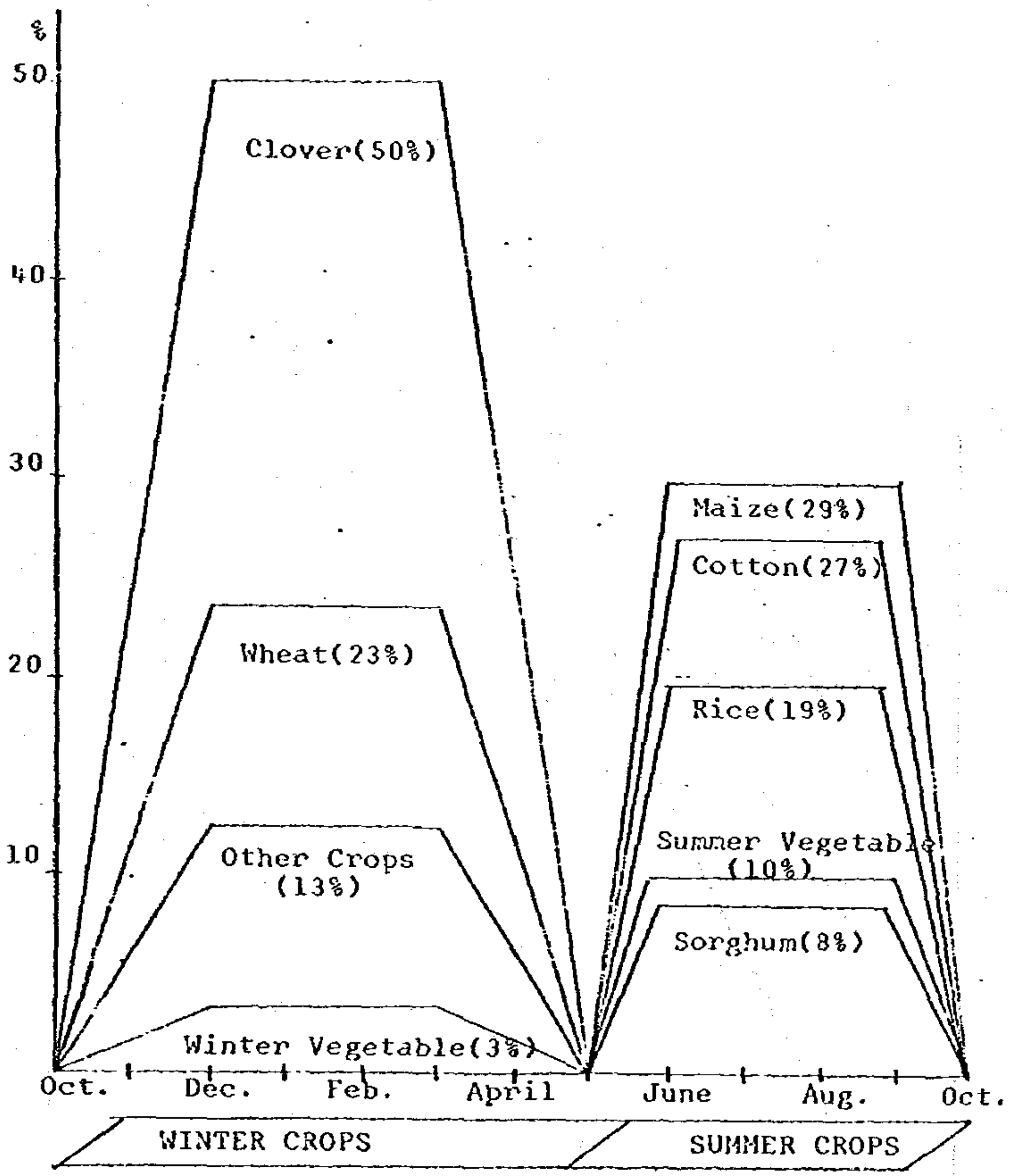


Fig. 4 Cropping Patterns and the Proportions of Production Area of Major Crops in Egypt

Source: EGYPT, Major Constraints to Increase Agricultural Productivity, USDA Foreign Agricultural Economics Report No. 120

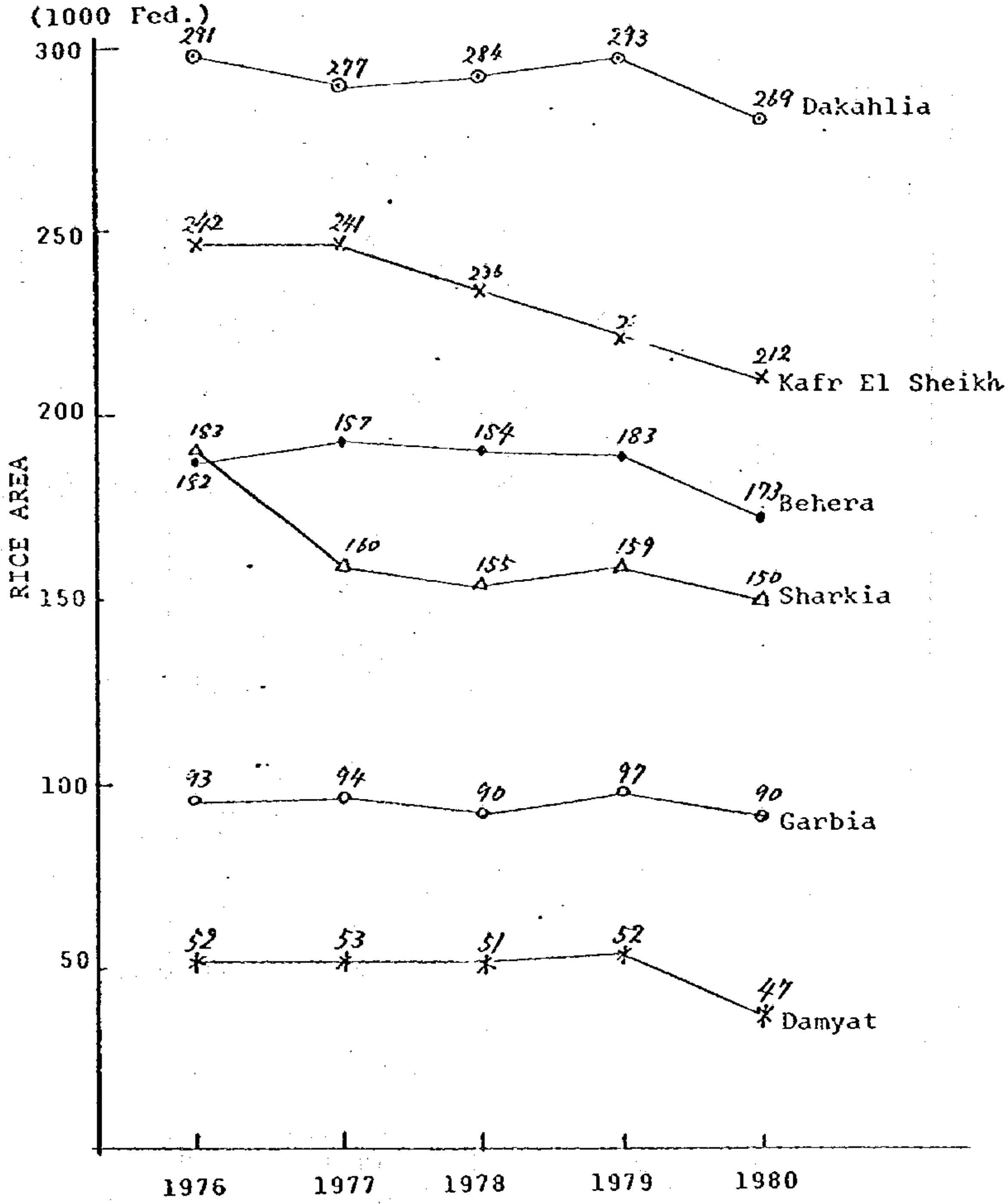


Fig.5 Recent Trend of Rice Area by Governorate in Northern Delta Rice Zone

Source: Agricultural Economics Dept., MOA, 1980

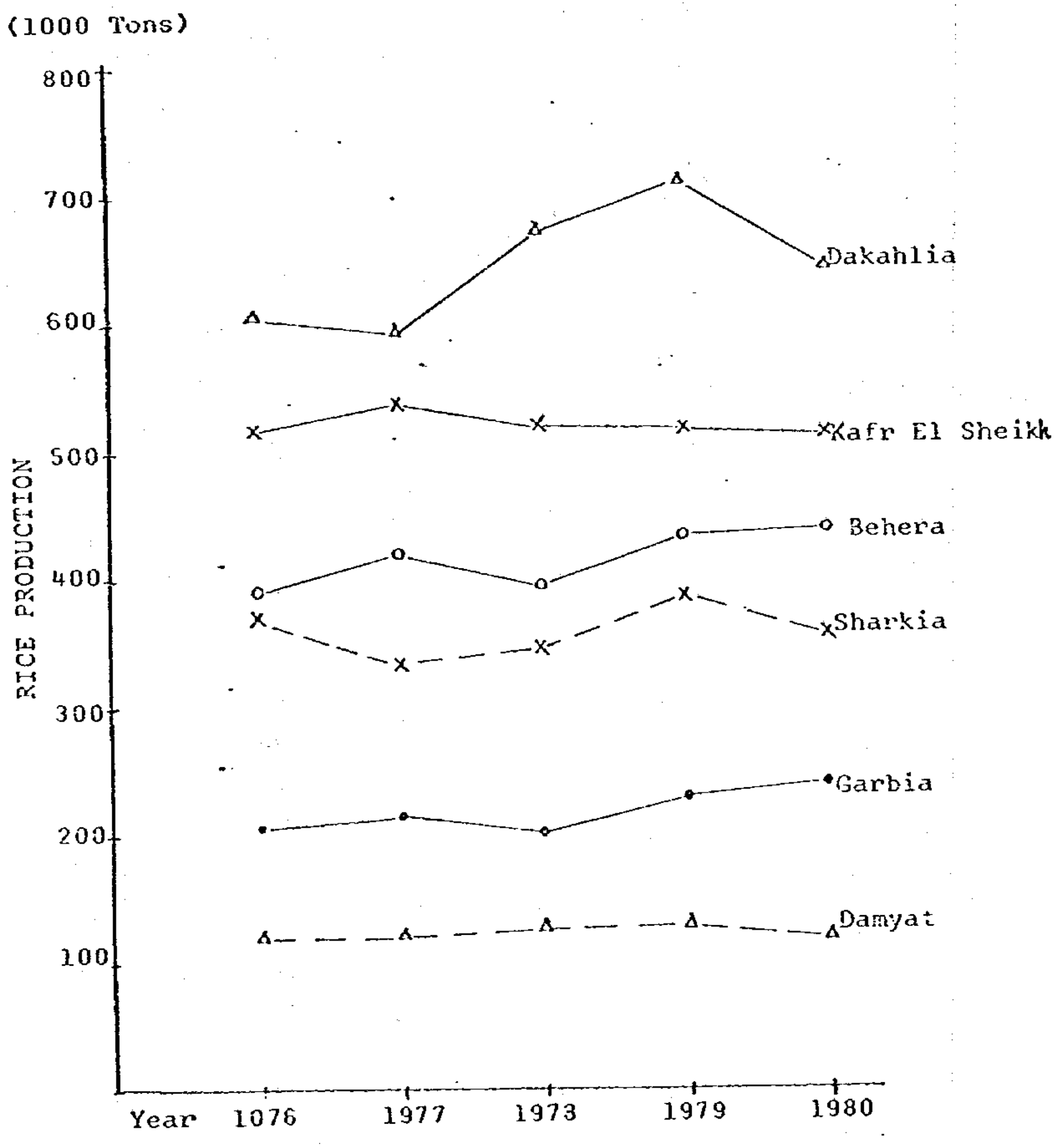


Fig. 6 Recent Trend of Rice Production by Governorates in the Northern Delta Rice Zone

Source: Agricultural Economics Dept., MOA, 1980

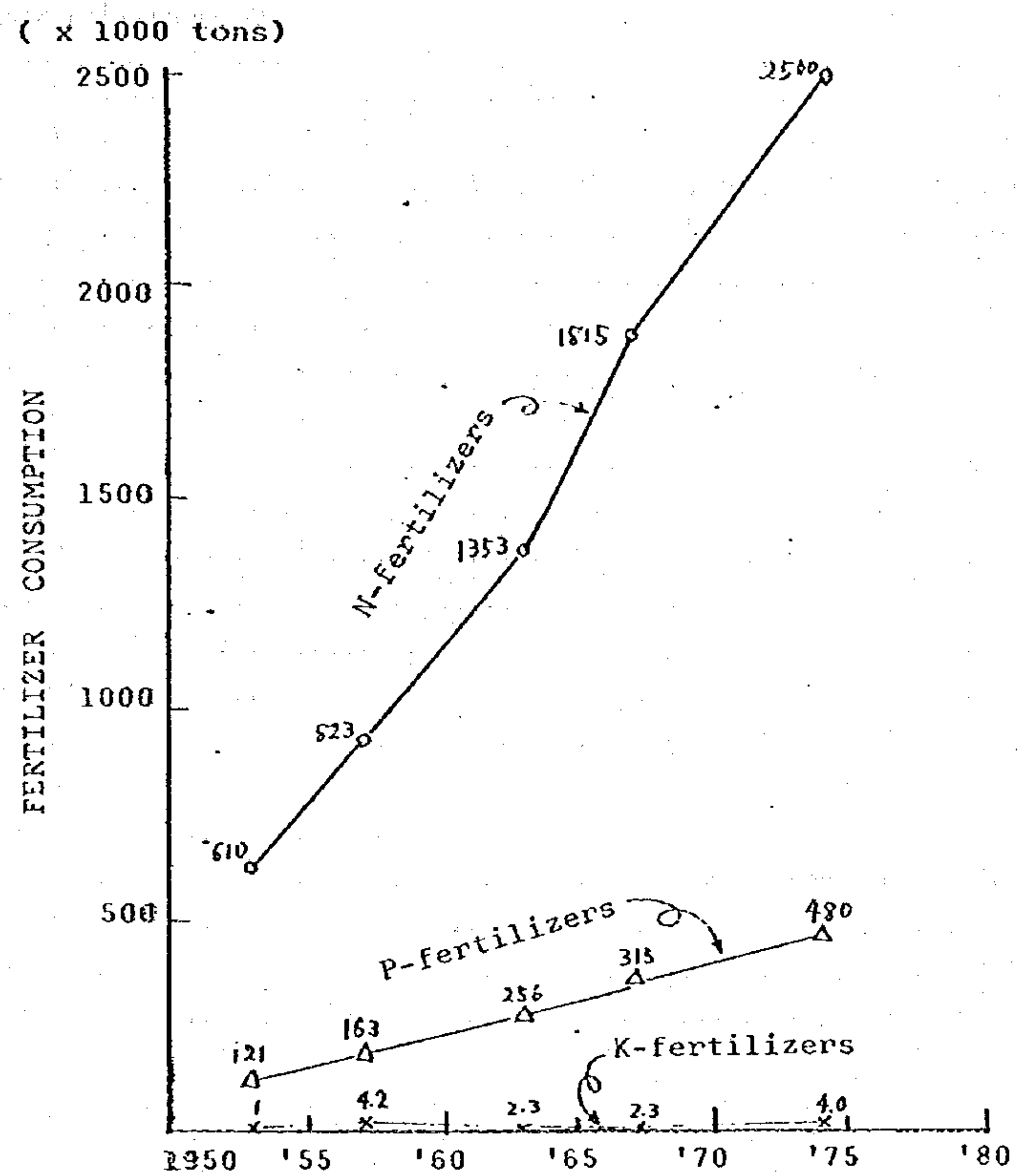


Fig. 7 Trend of Fertilizer Consumption in Egypt during the 1950 to 1975 period

Source: H.A.El-Tobgy, Contemporary Egyptian Agriculture, Second Edition, 1976

Table 1. The Quality of Raw Water from the Nile at Cairo, 1976 - 1977

Characteristic	Concentration Range
Temperature, °C	13 - 29
Turbidity, JTU	7 - 25
Total suspended solids (105°C), mg/l	5 - 60
Total dissolved solids (105°C), mg/l	170 -300
pH	7.4- 8.9
Total alkalinity (as $CaCO_3$), mg/l	110 -140
Total hardness (as $CaCO_3$), mg/l	110 -150
Magnesium hardness (as $CaCO_3$), mg/l	28 - 84
Chlorides (CI), mg/l	12 - 30
Sulfates (So_4), mg/l	13 - 21
Fluorides (F), mg/l	0.1- 0.2
Ammonia (N), mg/l	Not Detected
Nitrite (N), μg/l	0 - 33
Nitrate (N), μg/l	10-1000
Total organic nitrogen (N), mg/l	0.5- 3.2
Total phosphates (PO_4), μg/l	70 -376
Silica, mg/l	4 - 11
Electrical conductance (μmho/cm^2)	300 -400
BOD (mg/l)	1.3- 5.4
COD (mg/l)	13.8-21.4
Dissolved Oxygen (mg/l)	5.6 -8.6

Source: WATER WORKS MASTER PLAN, Greater Cairo Waterworks Development Programs, Ministry of Housing and Reconstruction, Arab Republic of Egypt, Feb. 21, 1979

Table 2. PRODUCTION COST & NET INCOME OF RICE PER FEDDAN AS OF 1980

I. Nursery Bed Preparation and Seedling Raising

Item of expence and labour	Cost
Seed, 350 kg	35 LE
Manure, 300 cages on donkey-back	48
Irrigation by SAKYA	14
Plowing(tilling) by tractor	5
Leveling of wet soil by animal	11
Edging and sowing	5
Ammonium sulphate, 150 kg	7
Superphosphate, 100 kg	3
Zink sulphate, 10 kg	5
Hand Weeding, 3 times	15
Harvesting of seedlings	45
Total =	193 LE

Note: One feddan nursery bed can generally supply enough seedlings to cover 8 feddans of rice field, but part-time workers trans-plant excess number of seedlings per hill. The above data is the cost of 1-feddan nursery bed for 5-feddan rice field. Therefore, the total cost should be divided by 5 to get the seedling cost for 1-feddan transplanting. 193 ÷ 5 = 38.5 LE, Say 40 LE.

II. Transplanting to harvesting in 1-feddan rice field

Plowing (tilling) and leveling	16 LE
Tra sport of seedlings	10
Transplanting by hand	22
Weeding by hand	15
Irrigation for whole season	20
Ammonium sulphate, 150 kg	7
Superphosphate, 100 kg	3
Harvesting, 10 men	20
Binding and bundle collection	4
Loading and transport on camel-back	10
Bundle standing at threshing area	1
Threshing by tractor	3
Overturning of straw and grain	13
Grain transport to cooperative	5
Rental fee for 1 feddan	40
Total =	192 LE

III. Production Cost, Income and Net Income per Feddan

- Production cost: 40 + 192 = 232 LE
- Income: (1.5ton x 75 LE/ton)* + (1.5ton x 100LE/ton) = 262.5 LE
- Net Income: 262.5 - 232 = 30.5 LE (very small benefit)

* Egyptian farmers are obliged to offer 1.5 ton/feddan at the fixed price of 75 LE per ton.

Annex 1. Machineries and Equipments in R.M.P

I. Pumps for irrigation and drainage: Some 4,500 to 7,500 tons(m^3) of irrigation water per feddan per year is required in rice farming. Therefore, the following pumps seem to be sufficient.
- For irrigation: Vertical pump with 100 mm(4"), 5PS, ... 4 unit
- For drainage: Handy drainage pump with motor, 50 mm 4

II. Agricultural Machineries

(1) Seeding plant and its accessory* .... 2 unit
(2) Plowing and puddling machineries
- Tractor, 25-30 PS, regular and cage wheels 2
- Chisel Plow, 5-nailed 2
- Rotary harrow 1
- Puddling harrow (Rotor) 2
(3) Transplanting machine
- Riding type, 6-raw, easy turning 4
- Walking type, 4-raw 2
(4) Harvesting machineries
- Combine, 4-raw riding type 2
- Combine, 2-raw walking type 2
- Binder, 2-raw walking type 2
- Head feeding thresher with moving function 1
(5) Rice grain drying machine, 3-4 tons' capacity 1
(6) Rice grain processing machineries
- Husking machine 1
- Polishing machine 1
(7) Plant protection machineries
- Power sprayer, tractor mount type 1
- Power sprayer, stationary type 1
- Power duster, tractor mount type 1
- Power duster, knapsack type with 40m plastic hose 1
(8) Other machineries
- Fertilizer broadcaster 2
- Manure spreader 1
- Dril seeder 1
- Tractor for general use, 60PS, with accessories such as disc plow, bottom plow, disc mower, front loader, rear rake, trailer, etc. 1
- Tractor for field operation, 60PS, crawler type, with blade, pan breaker(subsoiler), and back hoe 1
(9) Equipment and workshop
- Drilling machine, -Grinder, -Cutter, -Electric welder, -Charger, -Lathe for metal work, -Wood work kit etc.
(10) Spare parts of machineries listed above for 5-year use

III. Cars and Tracks for lia isoning and transport

- Microbus, 20 persons 1
- Land cruiser 1
- Track, 2 tons 1
- Track, 5 tons 1
- Bicycles for field inspection 5

IV. Equipments for demonstration: -Copying machine, -Typewriter(E/J), - 16 mm movie projector, -16mm movie camera with zoom lens, -35mm slide projector, -series of films introducing Japanese rice cultivation technology, agriculture, horticulture and culture, -portable loud speaker,-video scope etc.

* Soil crusher with sieve, fertilizer mixer, germinator, seeder, soil layer, nursery tray shelf, handy water tank etc.

Annex 2. Materials and Agricultural Chemicals needed for R.M.P.

I. Nursery plastic trays to cover 100-feddan demonstration farm:

It is very important to grow uniform seedlings to supply to the transplanting machine. Old Japanese proverb says that good seedlings already promise half yields of the year. Good seedling mat can be grown on a plastic tray, sized 30 x 60 x 3 cm. This tray is needed about 340 trays per one ha's mechanical transplanting, in case of medium size seedlings (15-20cm, with 3.5-4.5 leaf age).

Therefore, the mission has figured out the needed number of plastic nursery trays as follows:

340 x 50(nearly equal to 100 feddans) = 17,000

II. Plastic mesh sacks for combine harvesting and drying:

Supposing the average yield per 1 ha is 6 tons, the grain receiving sacks may be needed about 200 per ha. Therefore, 10,000 net sacks may be required for 100-feddan rice farm. If possible, 20,000 plastic mesh sack for combine harvesting and drying are welcome.

III. Agricultural Chemicals for 100- feddan rice from for 5 years:

(1) Insecticides and Acaricides for Stemborer and other pests;		
- Karphos 50% E.C.	0.5ℓ/f x 3 x 100 = 150ℓ x 5 =	750ℓ
- Karphos 2% dust	15 kg/f x 3 x 100 = 4500kg x 5 =	22500 kg
- Diazinon 10% Granule	6 kg/f x 3 x 100 = 1800kg x 5 =	9000 kg
- Diazinon 60% E.C.	0.5ℓ/f x 3 x 100 = 150ℓ x 5=	750ℓ
- Sumithion 50% E.C.	0.5ℓ/f x 3 x 100 = 150ℓ x 5=	750ℓ
- Sumithion 2% dust	15 kg/f x 3 x 100 = 4500kg x 5=	22500 kg
(2) Fungicide and Antibioties for diseases control;		
- Tachigaren 30% liquid	0.16ℓ/f x 3 x 100 = 48ℓ x 5=	240ℓ
- Kitazin 17% granule	6 kg/f x 3 x 100 = 1800kg x 5=	9000 kg
- Rabcide 50% W.P.	0.5kg/f x 3 x 100 = 150kg x 5=	750 kg
- Hinozan 50% E.C.	0.5kg/f x 3 x 100 = 150kg x 5=	750 kg
- Benlate 50% W.P. (Seed Dresser)	0.12kg/fx 1 x 100 = 12kg x 5=	60 kg
(3) Herbicides and Weedkillers		
- Saturn 50% E.C.	2 ℓ /f x 1 x 100 = 200ℓ x 5=	1000ℓ
- MO 25% E.C.	6 ℓ /f x 1 x 100 = 600ℓ x 5=	3000ℓ
- Ronstar 50% E.C.	2 ℓ /f x 1 x 100 = 200ℓ x 5=	1000ℓ
- Sanbird 10% granule	12 kg/f x 1 x 100 = 1200kg x 5=	6000 kg
- Basagran 50% E.C.	1.5ℓ/f x 1 x 100 = 150ℓ x 5=	750ℓ
- Gramoxon 25% liquid	1.2ℓ/f x 3 x 100 = 360ℓ x 5=	1800ℓ
(4) Rodenticides		
- Fratol 1% liquid	0.2ℓ/f x 2 x 100 = 40ℓ x 5=	200ℓ
- Zink Phosphate 1% granule	0.4kg/f x 2 x 100 = 80kg x 5=	400kg
(5) Spreader - stickers		
- Gramin liquid	0.2ℓ/f x 6 x 100 = 120ℓ x 5=	600ℓ
- Gramin-S liquid	0.2ℓ/f x 6 x 100 = 120ℓ x 5=	600ℓ

IV. Japanese Rice Seeds:

- Reimei ....100 kg
- Nihonbare ....100 kg
- Reiho ....100 kg

Annex 3

Field Soil Description Sheet

No.		Location	Mehalet El Kasab, Kafr El Sheikh Gov. (Elevation: about 4 m)	Land use		Weather at examination	Fine
Precipitation	45-55mm/annum						
Slope		Erosion	None	Topography	Flat	Geology	Nile Delta
Parent material Mode of deposition	Nile Deposit						

Sketch of Profile	Depth (cm)	Horizon	Sample	Texture	Gravel & Stone	Humus	Peat Muck	Color	Structure	Pore	Oxidative Sediments (Salts)	Mn	Fe^{2+}	Hardness	Plasticity	Stickness	Wetness	Roots	Remarks
	0-15	A_p		Clay	None	1%	–	10YR4/2	Weak, Sub angular blocky	many		traces	traces	Hard	Plastic	Sticky	Moist	Many-	
	15-150	C		Clay	None	less than 1%*		10YR3/4	Moderate-Strong, Angular blocky	many		"	"	Very hard	"	"	Wet	Many fine roots	* organic matter decreases gradually with depth (traces in the deep subsoil)

Vegetation	Rotation: Wheat - Rice	Application of Fertilizer	N P K Others manure	Drainage	fairy drained	Soil Group	Order: Vertisols Subgroup: Typic Torrerts	Soil Series
Form operator		Date 4th March 1981		Surveyer	Abdel-Wahed Ahmed Selim**			

** Soil Surveyer, Soil & Water Institute, Agricultural Research Center, Giza, Cailo, Egypt

Annex 3'

Results of Egyptian Soil Analysis

Item \ Soil Sample	Kafr Difiria (Sakha)	Mehalet El Kasab (Kafr El Sheikh)	Koom Elnaggar (Basyoon)
pH(Soil : H_2O = 1 : 2.5)	8.90	8.50	8.08
Electrical Conductivity μmho/cm25°C	626 μmho/cm^2	392 μmho/cm^2	1120 μmho/cm^2
Alkaline Earth Carlonates(lime)*	+ + +	+ + +	+ + +
$CaCo_3$ (%)	3.88	3.41	5.12
Organic Carbon (%)	1.15	1.65	1.22
(Humus %)	(1.98)	(2.84)	(2.10)
Total Nitrogen (%)	0.092	0.136	0.156
C/N Ratio	12.5	12.0	7.8
Ammonium Acetate(pH7) Extractable Cations (m.e./100g)			
Calcium (Ca)	55.0	62.0	68.0
Magnesium (Mg)	18.6	16.6	28.6
Sodium (Na)	9.4	4.7	4.1
Potasium (K)	4.1	2.3	4.3
Cation Exchange Capacity (CEC) m.e./100g	36.4	38.27	42.15
Exchangeable Sodium Percentage (ESP)%	25.81	12.3	9.72

* Alkaline-Earth Carbonates by Effervesence with diluted HCl +++ moderately or highly

	Coarse Sand %	Fine Sand %	Silt %	Clay %	Texture
Kafr Difiria	0.7	27.1	43.7	28.5	LiC
Mehalt El Kasab	0.5	27.3	41.7	30.5	LiC
Koom Elnaggar	0.7	24.1	52.7	22.5	SiCL

Signature: A Iseki

Akira Iseki

Senior Research Officer
Soil Survey & Classification Lab.
National Institute of
Agricultural Sciences

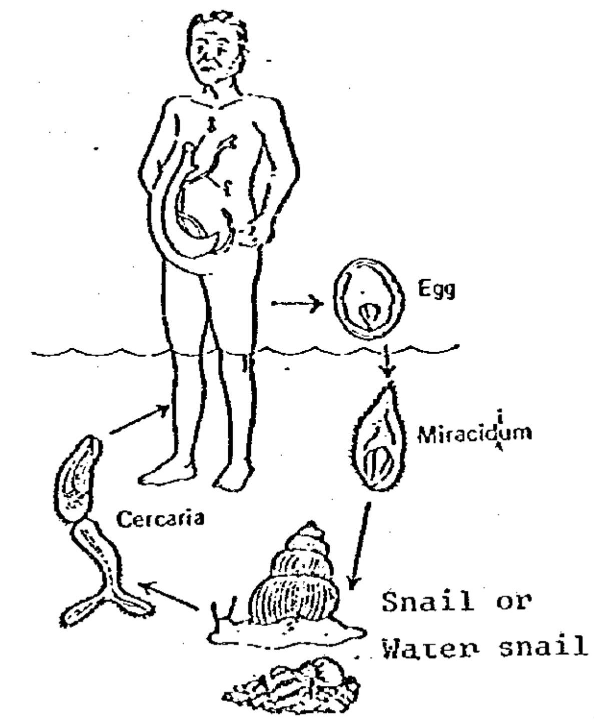
Date: May 28, 1981

Annex 4(page 1) Some Measures for Prevention of Schistosomiasis

The birthplace of the Schistosome mansoni and Shistosome haematobium is originally the Continent of Africa. Especially in the basin of the Nile river, a number of these schistosomes reaches to a considerable extent. Therefore, it is afraid that many Schistosome mansoni and S. haematobium live in the project area in the Northern Delta Rice Zone.

These parasitic organisms are generally called as BILHARZIA in Egypt. However, no active preventive effort has been payed to irrigation water and wet farmland except urban drinking water.

As shown in the following figures, the miracidium hatched from egg actively moves in water, and intrude into a anail, the middle host for schistosomes. Then the sporocysts are produced through the multiple division of miracidium within the snail. The daughter sporosyst is grown and moves to the liver of the snail, and then many cercarias are formed. These cercarias move into water and find their way into the mammals.



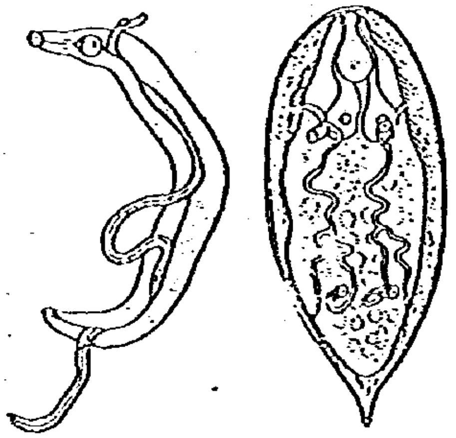
Infection Course and its Prevention

As stated above, the cercarias move into water by leaving the snail, and attach themselves to the skin of human body. However, cercarias can not be alive for more than 24-28 hours even at the optimum temperature of 23°C. The cilia of cercaria is easily taken off by a violent water agitation by pumping or spraying, and all the cercarias loose their cilia and can not intrude into human body anymore.

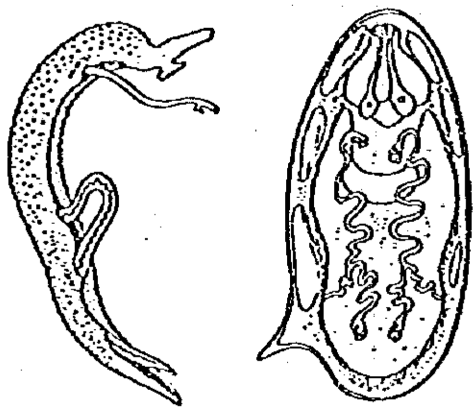
However, it has been impossible to exterminate the schistosomiasis because of the snail, the middle host, which provide thousands of cercarias continuously during the season.

Water snails are generally small, and young snails are much smaller than the adult. Therefore, young snails are easily transported by water flows. In supplying raw water for irrigation, young snails may start propagate in canals, ponds and also in paddy-fields. The snails living along the basin of the Nile might be Biomphalaria or Bulinus tropics, which can be the middle host for BILHARZIA.

As shown in the next figures, a schistosome looks like an eelworm in appearance, but has a sucking mouth. The size of schistosome is 8-22 long and 0.5 mm wide.



Schistoma Haematobium and its Egg
(Quoted from the Faust, Russell & Jung)



Schistosoma Mansoni and its Egg
(Quoted from Faust, Russell & Jung)

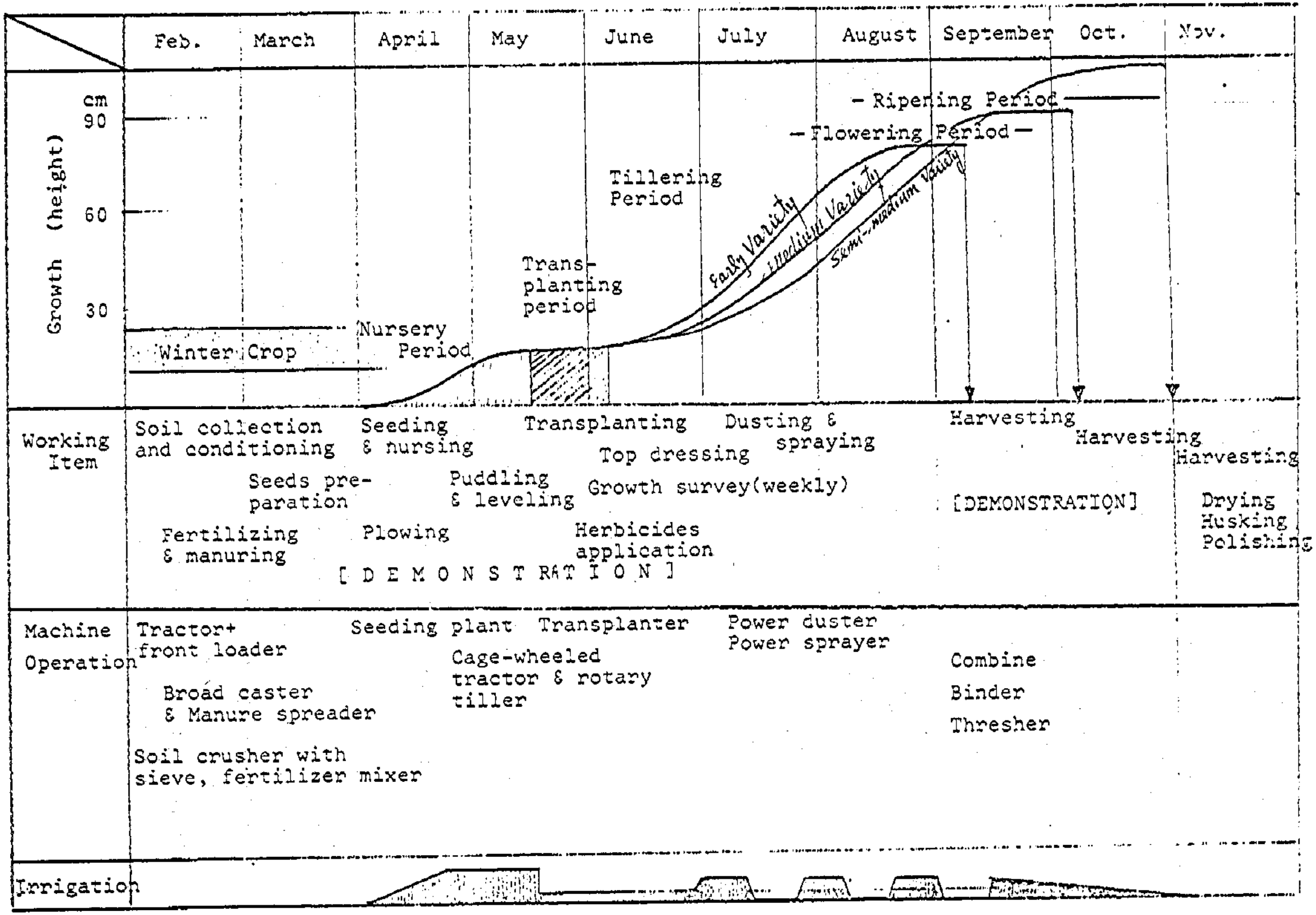
The snails have durability against chemicals. However, they can not live without sunshine and enough algae.

How to prepare water for seed soaking and nursery raising:

The mission would like to have following reservoir which has sunlight-proof cover and violent agitation function such as air bubbling and rapid streaming to prevent the propagation of the snails and moving of cercarias. Some filtering sieve also can reduce the existence of BILHARZIA in the water for laboratory and nursery procedures. Some medical survey during the project period in the project site is expected.

Source: Report on the urban water supply project in the greater Cairo, the Arab Republic of Egypt, JICA, 1976

Annex 5. Detailed Chart of Rice cultivation Technology by Agricultural Machineries



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First Secretary, Mr. Osamu MORIMOTO

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Mr. Masao YAMAWAKI, Irrigation Advisor

Mr. YANAGISAWA, Economic Advisor, Hattem Committee

MINISTRY OF AGRICULTURE

AND ITS ORGANIZATIONS & COMPANIES

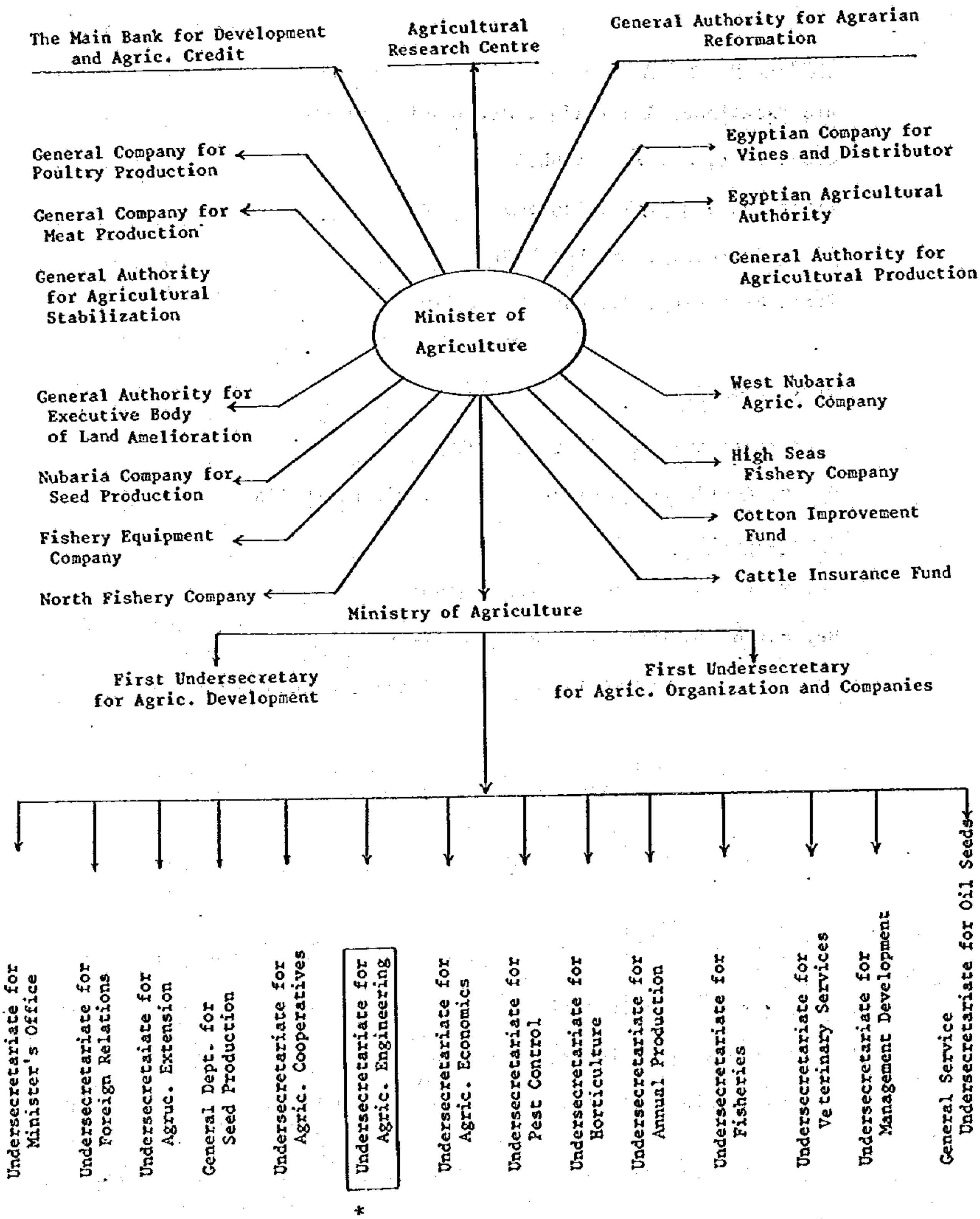
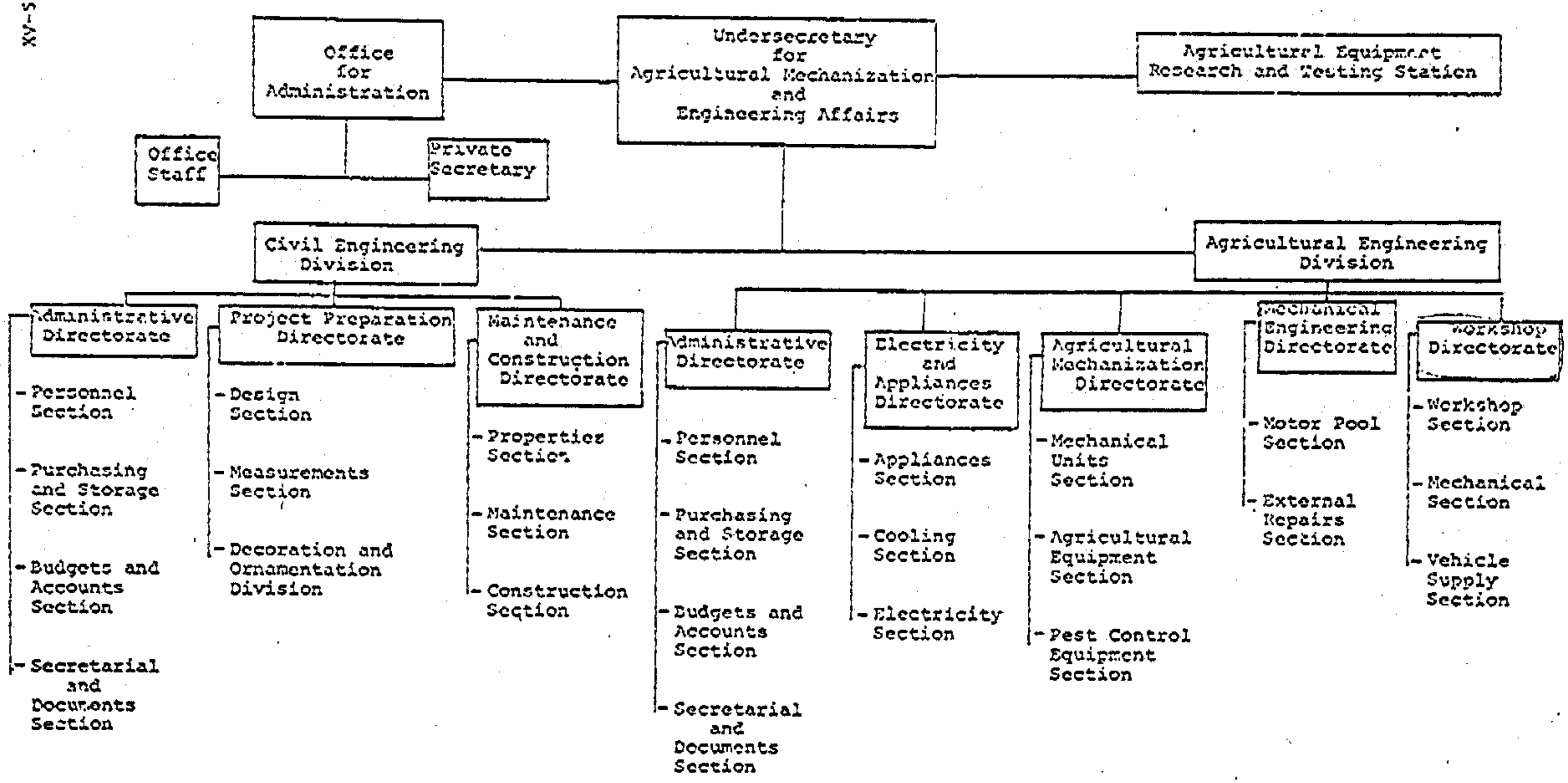


Chart 1

XV-5

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND ENGINEERING AFFAIRS



JICA