PRELIMINARY SURVEY REPORT
ON
AGURICULTURAL DEVELOPMENT PROJECT
IN
THE REPUBLIC OF IRAQ

November 1977

JAPAN INTERNATIONAL COOPERATION AGENCY

PRELIMINARY SURVEY REPORT
ON
AGURICULTURAL DEVELOPMENT PROJECT
IN
THE REPUBLIC OF IRAQ

November 1977

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In compliance with the request of the Government of the Republic of Iraq, the Japan International Cooperation Agency dispatched to Iraq a preliminary survey team for agricultural development for three weeks from 16 June 1977.

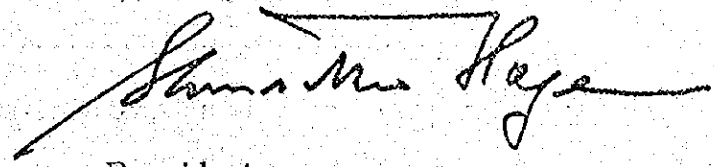
The team studied the feasibility of increasing rice production in the country and discussed with officials concerned of the Iraqui Government on how to attain the intended development.

This report contains the results of the preliminary survey and recommendations of the team. I hope it will be of use for the formulation of measures for rice production increase of Iraq.

I wish to express my gratitude to the officials concerned of the Iraqui Government for their cooperation extended to the team and sincerely hope that our mutual efforts of this kind will serve to strengthen the friendly relations between Iraq and Japan.

November 1977

Shinsaku Hogen



President

Japan International Cooperation Agency

TABLE OF CONTENTS (Tentative)

RECORD OF SURVEY

Month	Date	Time	Descriptions
June	14	13:50	Left Tokyo by JL463
	15	02:00	Arrived at Teheran
	16	12:00	Left Teheran by IA103
		12:00	Arrived at Baghdad
		14:00	Made Courtesy call at Embassy of Japan, Bagdhad
	17	10:00 - 12:00	Held Mission meeting on survey schedule
		15:00 - 17:00	Visited Musium
	18	09:00 - 12:00	Held meeting with Ministry of Agriculture & Agrarian Reform (Survey schedule and confirmation of the requested issues)
	19	07:00	Left Bagdhad for Najaf for carrying out the field survey
		09:00 - 14:00	Visited Agriculture Office and Province Office, and made general survey on paddy cultivation around Najaf
		17:00 - 20:00	Visited Rice Experiment Station
	20	08:00 - 14:00	Made survey on paddy cultivation in the areas around Najaf, and visited silo for storing cereals
		17:00	Left Najaf for Diwaniya, the Capital of Kadisyah Province
		20:30 - 21:00	Visited Agriculture Office
	21	07:30 - 16:00	Visited Damas District, Shamiya District and Mahnawya District to make survey on paddy cultivation, invited by village Cooperative to Luncheon Party
	22	07:30 - 14:00	Left Diwaniya for Samawa City to make survey on paddy cultivation in the City and its vicinity
		17:00	Left Samawa for Nasiriya, the Capital of Dhiqar Provence
		19:30	Visited Agriculture Office
		21:00	Lodged in Shatrah for overnight

Month	Date	Time	Descriptions
June	23	07:00 - 12:00	Left Shatrah for Sugash - Shuyuka Districts to make survey on paddy cultivation in marsh lands
		14:00 - 21:30	Visited Agriculture Mechanization Center and made survey on paddy cultivation in 30 July Project
	24	06:00	Left Shatrah for Bagdhad
		12:00	Arrived at Baghdad
		18:00 - 20:00	Held Interim Meeting with Mission members
	25	09:00 - 12:00	Held Interim Discussion Meeting with Iraqui Government Officials concerned at Office of Ministry of Agriculture and Agrarian Reform
	26	08:00	Left Baghdad for Amara City, Capital of Missan Province
	27	07:00 - 12:00	Made survey on paddy cultivation in the marsh lands in the Mijar-Al-Kabir District, about 30 km south from Amara
		17:00 - 20:00	Visited Kumait Experiment Institute
	28	07:00 - 14:00	Made survey on paddy cultivation in Salam of the Maymuna District, about 30 km south-west from Amara City
	29	07:00 - 13:00	Made on paddy cultivation in the marsh lands around Kahala
		17:00 - 22:00	Visited the State Farm in Ali-Al-Shargi, about 60 km north from Amara City and made survey on paddy cultivation in that area
	30		Mission members were organized into two parties
		06:00	The one party left Amara for Baghdad
		07:00	The other made survey on paddy cultivation in the Maymuna District about 30 km south from Amara
July	1	06:00 - 12:00	The latter party left Amara for Baghdad to join the former party
	2	08:00 - 10:30	Held meeting with Mission member for arranging the survey results obtained to that date

Month	Date	Time	Descriptions
July	2	12:00 - 14:00	Held meeting with the Government Officials concerned at Ministry of Agriculture and Agrarian Reform.
	3	08:00 - 09:00	Visited Ministry of Irrigation
		12:00 - 13:00	Visited Embassy of Japan to make report on the result of the survey conducted
		20:00 - 22:00	Invited to the Dinner Party by the Iraqi Government concerned
	4	09:00 - 10:00	Made courtesy call on the Secretary-General of Ministry of Agriculture and Agrarian Reform
		10:00 - 14:00	Visited the Office of the Directorate of Cotton and Oil Seed Development Project in Ministry of Agriculture and Agrarian Reform, confirming the request for the cooperation of Soybean production and collected the related data
		20:00 - 22:00	Held Dinner party inviting the Government Officials concerned
	5	12:00	Left Baghdad for Tokyo via Bombay by JL472
	6	23:00	Arrived at Tokyo

CHAPTER I. GENERAL OBSERVATION

The Agricultural Survey Team for Iraq dispatched by International Cooperation Agency of the Japanese Government (hereinafter referred to as "the Team") visited the Republic of Iraq and stayed there from 16 June to 5 July of 1977. The Team consisted of a leader and six members as listed in the Annex to this Report.

During its stay in the country, the Team had three joint sessions of the meeting with the officials representing Directorate-general of Field Crops, Directorate-General of Agricultural Projects, Office of Under Secretary and other agencies of the Ministry of Agriculture and Agrarian Reform (hereinafter referred to as "Agriculture Ministry").

The Team made two field trips to the main rice producing areas in the lower river basins of Tigris and Euphrates, spending five days for each trip.

As shown in the itinerary annexed to this Report, the Team visited rice growing fields, agricultural cooperatives, experiment stations, irrigation facilities such as pump stations, rice silos and agricultural training institute. Throughout the field trips, the Team was fully attended by a staff-member of the Agriculture Ministry. And in every province the Team was guided by the Chief of the provincial agricultural office and relevant officials of the province. The leaders of cooperatives, farmers and other local people with whom the Team contacted were very friendly without exception.

Although the Team could work very efficiently both in Baghdad and rural areas, the period of the Team's stay in the country was too short. The field observation was inevitably confined to only a part of growing period of rice, i.e., early growing stage. This shortage of actual observation was supplemented as much as possible by the study of available data and information. In addition, the experiences in Japan in rice production increase were taken into account in preparing the present report.

The Team is fully aware of the danger often entailed in the recommendations based upon a hasty observation by foreigners, neverthless it believes that the observation and recommendations presented in this Report would serve useful purpose for the Iraqi government in planning rice production increase in the Republic.

1-1 Characteristics of Rice Culture in Iraq

In terms of planting area, rice ranks third among various field crops grown in Iraq. The rice planted area in 1976 was about 50,000 hectares. It was largest among summer crops but very small if compared with those of winter crops; the planted area of wheat and barley, which are the most important winter crops, were about 1.5 million hectare and 0.6 million hectare respectively in 1975-76. This indicate that winter crops are much more important than summer crops.

However, rice outweighs wheat and barley by far in terms of yield. The national average of rice yield is about 3.1 ton per hectare compared with 0.9 ton of wheat and 1.0 ton of barley.

Rice in Iraq, as well as in other arid or semi-arid countries in Middle and Near East and Africa, is grown under irrigation in extremely hot and dry season. It is a sharp contrast to the rice culture in tropical monsoon Asia where rice is grown in rainy season depending on abundant rainfall and natural flooding of rivers.

Exceptions to the above contrast are the rice culture in marshland in Iraq, notably Missan Province and, on the other hand, the dry-season rice culture in tropical monsoon Asia.

The main feature of the marshland rice culture is transplanting rice seedlings as the water level of marsh receeds in early summer. Since water supply to the rice plants can not be controled, the yield is lower than irrigated paddy.

The practice of dry-season rice culture is increasing in monsoon Asia, but it accounts only a small portion of rice planted area due to the shortage of available water in dry season and/or the lack of irrigation facilities. It is worth noting that the yield in dry season, if sufficient water is supplied, is higher than in rainy season.

1-2 Possibility of Increasing Rice Production

Expansion of area under cultivation and raising productivity of land already exploited are the directions for increasing agricultural production. If these two directions are taken simultaneously the total output could be greatly increased as the multiple effect. A good example is the great increase of maize production in Thailand in the decade of 1955-1965; production increased

from 50,000 tons in 1955 to one million ton in 1965. This twenty fold increase in production was attained as the multiple effect of eight times increase in planted area and 2.5 times increase in yield per unit area.

(1) Expansion of Rice Planting Area

The possibility of expanding rice planting area in Iraq depends mostly on the availability of irrigation water. The main source of the water is the flow of twin rivers and their tributaries.

The flow of twin rivers is abundant in absolute volume. The average annual flow of the Tigris is 47.1 billion m^3 (at Fatha) and that of the Euphrates is 28.1 billion m^3. The problem, however, is the large seasonal variation of the flow. The highest monthly flow of the Tigris occures in May at 3,140 m^3/sec as against the lowest flow of 356 m^3/sec in September. Likewise, that of the Euphrates in May is 2,337 m^3/sec as against 271 m^3/sec in September. Much of the flow of these two rivers comes in April-May at a time too late to benefit winter crops and too early for summer crops.

Due to this uneven flow of the rivers, flood damages often accure in Mesopotamian plain in spring, and, in order to avoid the flood, surplus water is discharged into desert areas. On the other hand, summer crops are frequently suffered from shortage of irrigation water.

The need for storage of water for the purpose of controlling floods and increasing supply of water for irrigation had long been felt. As early as in 1951, the World Bank Mission pointed out that the twin rivers can provide large amount of water for irrigation and the area under cultivation might be almost tripled by means of water storage.

Since the Team has not studied the master plan of water resource utilisation of the country, it is not qualified to make any estimate of the possible expansion of rice planting area. The Team, however, is informed that out of 6.5 million hectares irrigable by Tigris River 2.2 million hectares are presently irrigated. Likewise, one million hectares is now irrigated by Euphrates River and it is planned to be expanded to 1.5 million hectares.

The Team had an impression, as the result of its field inspection, that there was considerably large area which could be irrigated for rice by making more efficient use of available water even before the completion of big reservoir projects. The Team believes that more efficient use of water would

also bring about higher yield as is discussed in detail in later chapters.

(2) International Comparison of Yields

The national average of rice yield in Iraq varies from year to year. In the past six years (1971-1976), it ranged from 505.8 kg to 779.3 kg per Donum, or about 2-3 tons per hectare. The average yield in 1975 is compared with those of other countries in the following table.

Table - 1 Yield in Different Country

	Yield kg/ha	Harvested area 1,000 ha
Japan	6,185	2,765
Spain	6,052	62
Italy	5,801	174
Egypt	5,326	460
South Korea	5,324	1,218
Greece	5,152	19
Australia	5,119	76
U S A	5,105	1,134
North Korea	5,000	740
Keniya	4,923	7
USSR	4,000	500
Iran	3,697	375
Syrian Rep.	3,667	1
China	3,235	36,000
Iraq	2,778	72
Saudi Arabia	2,721	1
Indonesia	2,686	8,599
Pakistan	2,271	1,675
Afganistan	2,143	210
Burma	1,827	5,111
India	1,826	38,600
Bangladesh	1,825	10,117
Thailand	1,771	8,520
Philippine	1,760	3,770

	Yield kg /ha	Harvested area 1,000 ha	
Laos	1,338	680	
WORLD	2,441	140,880	

Source; FAO Production Yearbook 1975.

As seen in the above table, the average yield in Iraq is about equal to the would average and higher than those in the countries of tropical Asia where rice is the most important crop. However, a simple comparison of yield, disregarding the harvested area is often misleading. It must be noted that while the figure for Iraq is the average of only 50,000 hectares of rice planted area, those for tropical Asian countries, such as Thailand and Indonesia, are the averages of millions of hectares.

In tropical Asian countries, as mentioned earlier, rice is mainly grown in rainy season under natural flooding of rivers. Some areas suffer from too-much water and in others insufficient flooding. Where flooding is too deep, high yielding varieties of short culm such as IRs can not be grown. In some areas, farmers grow floating rice which is as tall as three meters or more but the yield is very low.

The top-ranking countries in the above table with the national average yield exceeding 5 tons /hec. are Japan, Spain, Italy, Egypt, South and North Koreas, Greece, Australia, U S and Keniya.

Differing from tropical Asian countries, rice is not a main crop in these high-yielding countries except for Japan and Koreas. In Spain, for example, the average yield is 6 ton/ha. which is almost equal to that of Japan, but the rice planting area of Spain is only 62,000 hectares compared with 2.7 million hectares in Japan. Australia had a record highest yield of 6.8 ton/ha in 1973, surpassing Japan's yield, but it was the average of only 45,000 hectares.

From the point of economic development stage, eight countries out of the ten high-yielding countries are highly developed or relatively developed countries, and two are "developing countries". It is encouraging for Iraq to know that these two developing countries, i.e., Egypt and Keniya, are arid

countries where rice is grown under extremely hot and dry condition similar to that in Iraq.

While the yield in Keniya, 5 ton/ha, is the average of only 7,000 hectare, that of Egypt, 5.3 ton/ha, is the average of 460,000 hectare. Study on rice culture in Egypt would be useful for Iraq both in expanding rice area and increasing yield.

1-3 Rice Culture in Egypt in Comparison with Iraq

The main rice producing area in Egypt is the northern part of lower Nile delta. Rice culture there depends entirely on irrigation.

The annual flow of the Nile is about 119 billion m^3. After deducting the evaporation from the vast swamps in the south, dams and river surface, the usable water is estimated at 74 billion m^3, of which 55.5 billion m^3 and 18.5 billion m^3 are allocated respectively to Egypt and Sudan by the agreement between the two countries.

The water allocated to Egypt is not much larger than the total usable flow of Tigris and Euphrates rivers in Iraq. However, the seasonal distribution of flow of the Nile differs from that of the twin rivers. While the highest flow of the twin rivers occures in April-May and lowest in September, the flow of the Nile is converse, being highest in September and lowest in May. This flow pattern of the Nile favors for summer crops especially cotton and rice.

There is another difference between the Nile and twin rivers. The flow of the Nile, with the world famous Aswam Dam, is well regulated and irrigation systems are fully developed. Wherears the twin rivers, as mentioned earlier, still lack the storage facilities and efficient irrigation system.

In respect of cultural methods, direct broadcasting, which is commonly practiced in Iraq, had been the traditional method in Egypt but it was converted to transplanting method aiming at higher yield.

Rice varieties widely grown in Egypt are Japonica varieties which had been selected and bred by the agricultural experiment stations of the Egyptian government. Whereas the varieties used in Iraq are local varieties, notably Ambar, and high yielding Indica varieties (IR varieties) bred by the International Rice Institute (IRI) in Philippines.

The question as to whether Iraq should follow the Egyptian experience in respect of cultural methods and varieties is not easy to answer. The Team, however, feels that it would not be advisable for Iraq to totally convert the present broadcasting method to transplanting. Nor it would be advisable to completely replace Ambar with high yielding varieties such as Japonica and IRs. These points will be discussed in later chapters.

I-4 Rice Culture in Japan

Rice is by far the most important crop in Japan. It is cultivated throughout the country and the total planted area is 2.77 hectares. The national average yield of 6.18 tons/hectare is the highest in the world. Among 46 provinces (prefectures), the highest provincial average is 7.95 ton/ha. of Yamagata where about 100,000 hectares are planted with rice. This high yield of rice in Japan is the combined results of complete drainage/irrigation system, use of high-yielding varieties and elaborated cultural techniques including abundant input of fertilisers.

The main source of irrigation water is a large number of rivers well regulated by reservoirs. Rice varieties are all belong to Japonica type, short grain and more glutenous them Indica type. The national and prefectural experiment stations carry out selection and breeding of varieties. Seed multiplication and distribution system is well established throughout the country.

Research work on rice has a long history dating back to 1893 when the national agricultural experiment station was established. Since 1899, prefectural experiment stations began to be established with subsidies from the national government. At present, in addition to the central and regional agricultural experiment stations under the Ministry of Agriculture, every one of the 46 prefectures has its own experiment station. Research on rice is also carried out by a large number of Agricultural Colledges and Universities. As far as rice is concerned, Japan perhaps has the largest accumulation of research results.

The cultural methods practiced in Japan had long been labor intensive to get maximum yield from the limitted land. However, as the movement of labor force from agriculture to industry took place after the World War II, especially in the last two decades, labor productivity became a important problem. Devices had been made with success to increase yield

with less labor by the use of machines and chemicals. Transplanting is still predominant practice but it is now done by transplanting machines. Weeding labor has been almost entirely replaced by the use of herbicides. Direct seeding is also practiced in some areas with high yield comparable to transplanted rice. Study on the process in Japan of increasing both labor productivity and land productivity would be useful for Iraq.

CHAPTER II. SUMMARY RECOMENDATIONS

Various measures for the improvement of irrigation, drainage, field preparation, rice varieties, cultural methods including mechanisation have to be taken if rice production is to be increased in Iraq. In addition to these phisical or technical measures, social and institutional systems such as extension service, cooperatives, water-management and marketing mechanism have to be developed. These technical and institutional measures have to be carried out in an integrated manner, rather than separately, under the overall policy of the Government.

It would be difficult, however, for the Government to undertake these measures throughout the whole rice producing area of the country simultaneously, due to the financial limitation and shortage of technical personnel. At the same time, an uniform approach disregarding local differences in natural and social conditions would not be advisable. The Team, therefore, strongly recomend the Government of Iraq to undertake the Rice Production Increase Project as outlined below and to start as early as possible the feasibility study for the planning of the project.

The basic idea of the project is to integrate and concentrate various measures in an area demarcated as "project area". The measures which have been proven as effective in the project area will be spread with necessary modification over other areas. The technical and administrative personnel who gained experience in the project area may later be usefully assigned in other areas.

The first project area may locate in Missan or Najaf. The size of the project area may range 10,000-40,000 Donum (2,500-10,000 hectares).

A pilot farm of about 120 Donum (30 hectares) will be established in the project area as the nucleus of the project. The main functions of the

pilot farm will be: (1) to conduct experiment and trials with respect to varieties and cultural methods to ascertain their local adaptability, (2) to train technical staff of the project and key farmers in and around the project area and (3) to demonstrate actual practice of rice production. The pilot farm may well include some lands which belong to and cultivated by farmers so that recomended practices may be demonstrated by farmers themselves under the guidance of the technical staff of the farm.

The feasibility study as the basis for planning the project has to be as in detail as possible especially for the first project area. The study should consist of : (i) collection and analysis of data on hydrology, climate, topography and soils in the project area, (ii) formulation of plans for irrigation, drainage, field preparation, farm mechanisation etc., and (iii) measurement of economic feasibility of the project in terms of total input and the expected return therefrom. The organization, duration and estimated cost of such a feasibility study is presented in the attachment to this Report.

Since the project is an integral part of the national agricultural development and the forerunner of the rice production increase of the country, it has to be well coordinated with and supported by the overall agricultural policy of the Government. It is also important, not only for the success of the project within the project area but for its spreading effects over the country, that the project be supported by research and experiments together with the supply of technically qualified personnel. The Team, therefore, recomends that the Government take the following steps in parallel with the project.

(1) Integrated Planning for Rice Production Increase

As the basis of the national policy for increasing rice production, the Government should formulate an integrated plan which would include not only technical and phisial improvements but also institutional improvements such as, for example, extension service, type of production entity (cooperative production and state farms), rice price policy and marketing system. And such a plan should be well harmonised with the overall agricultural development of the country. And, for this purpose the planning and

coordination function of the Agriculture Ministry has to be strengthened. Foreign advisors of high calibre and good experience in planning and administration of agricultural development, particularly in rice production and irrigation/drainage, may serve useful purposes for the Ministry.

(2) Strengthening of Research and Experiments on Rice Culture.

Research and experiments on various subjects as mentioned in the following chapter are indispensable for the production increase of rice, but the present facilities and staff are far from satisfactory to conduct these experiments.

The Rice Experiment Station in Najaf is doing an excellent work with a small staff, but the experiment is almost confined to those on varieties, and very little has been done on other important subjects such as proper water depth, timing of water supply and drainage, spacing, fertilizer effects, planting time etc.

The Team was given to understand that another rice experiment station is going to be established in Missan. The Institute of Agriculture Technology in Missan is also planning to start research work on rice from the next season. The expansion of research and experiments on rice as planned is of course desirable, but, at the same time, the research works in these stations have to be carefully designed and coordinated in order to maximise the efficiency. Japanese experts on rice research would be useful for designing and assisting experiments.

(3) Training of Administraters and Technicians

Training of administrative and technical personnel is of primary importance for the success of rice production increase programs. The Institute of Agricultural Technology in Missan will play an important role in producing technical staff.

In addition to the vocational training and in-service training within the country for large number of required personnel, selected number of senior and middle-level personnel may well be trained in other countries such as Japan and Egypt.

CHAPTER III. TECHNICAL VIEW ON IRRIGATION AND DRAINAGE

3-1 Possibility of Increase in Paddy Production

In general, there are several unfavourable conditions for paddy cropping in Iraq, such as little rainfall, extreme aridity, high temperature, and high concentration of salinity in the soil and river waters; however, Iraq is blessed with a vast land and abundant river waters that will provide a fair possibility of paddy production increase by consolidating such agricultural infrastructure as irrigation and drainage facilities, land consolidation, and introduction of improved farming practices on the basis of the paddy cropping currently carried out.

The following two approaches are taken into account for the paddy production increase.

a) The one is to re-arrange and consolidate the existing paddy fields. This way will run little risk to achieve the successful end. There are a lot of existing field left intact in inability of gravity irrigation due to a little higher elevation of lands than the irrigation water level. Those fields will be smoothly irrigated with pumping facilities (only about one meter pump head available) provided, so that they can directly contribute to the production increase. The construction of such irrigation facilities will enable to properly control the water supply and will advantageously affect to the plant-physiology as well as to tilling, disalinization of soil and drainage to results in yield increase. And provision of drainage facilities will not only enable to eliminate the excess water in the existing paddy fields, but lower the groundwater table by subsurface drainage to accelerate the movement of waters in the soils. Those movements of water will be essentially important to supply oxygen and nutrient to the root zones of plants and to facilitate the disalinization of the soil. Besides the above, an emphasis is placed on the land consolidation as well. In the flooding irrigation, the land levelling is fundamentally important to maintain the flooding water depth even in whole field. Requiring much labor and techniques to make the land even, the levelling works should be implemented by employing possibly high civil engineering techniques. The basic farm land block should be

established to meet the requirements. The shape and size of the farm land block will be decided depending upon those conditions of topography, irrigation and rainage systems, farming machinery to be employed, etc. Also, the establishment of farm road networks is necessary for operation of farming machines, hauling of harvests and agricultural inputs, all of which have close relation to the yield increase. The various factors mentioned above are concerned with the acceleration in the yield increase in the existing paddy fields, and it may be considerably easy to implement without large and costly facilities.

b) The other is to reclaim the new paddy fields. There have been many riparian low-lying lands and marsh lands which will be reclaimed by application of civil engineering techniques. In parallel with consolidation works for existing paddy fields, those yet-unreclaimed lands should be surveyed to realize the development one after another by the priority of the results of feasibility study. In view of the production increase, the expansion of cropping acreage may contribute much more than yield increase per unit acreage, however, such project will require more investment and time to implement than the latter, and there may be a problem about the farmers who will cultivate newly developed lands. Being the case as such, the expansion of cropping acreage should be taken up as a secondary approach to the project.

3-2 The Fields of Japanese Technical Cooperation

The Japanese rice cultivation, being supported by considerably high price in the market, is carried out so intensively as to produce high yield per acreage. Naturally, it is unreasonable to apply directly the Japanese Engineering Standard to Iraqi agriculture. It appears, however, that the Iraqi agriculture should take an intensive approach to a certain extent in due consideration on the fact that water utilization has a limit, the salinity control has to be rationally carried out, and the existing farm land holding per farmer is very small. The Japanese farming, which shall be modified reasonably, will be applicable to contribute to the development of the Iraqi agriculture.

The field inspection made by the Team found that the realization of the land consolidation, improvement of farming practices and introduction of

related farm mechanization should be essentially required, and it is deemed necessary for Japanese technical cooperation to be rendered in stressing on these points.

3-3 Improvement of Existing Paddy Fields

The paddy cropping area in Iraq is roughly divided into two areas from the viewpoint of irrigation and drainage; one is the mid-basin of the Euphrates River (about 165,000 donums) and another is the lower basin of the Euphrates River and the Tigris River (about 163,000 donums).

The former area provides considerably favourable conditions for paddy cropping; the river water is comparatively good in its quality and runs abundant and the area will drain well. The latter area, some of which has similar conditions to the former, has problems on higher concentration of river water salinity, ill-drained areas due to low-lying flat land, and adversely effect from the water level in the marsh lands.

a) Security of intake water level

The water intake is currently carried out by gravity or pumping-up from the Euphrates River, its tributaries and branch streams, and while doing inspection, the Mission observed there were many pumps operated, which have been increasingly installed in the recent 10 years or so. However, many pumps are provided on different elevation due to no regularility in their installation. Making the field inspection in June, the high-water season, the Mission observed some pumps submerged, and those pumps seemed to be installed in the low-water season. Under the circumstances, it will be not readily available to provide the facilities for securing the intake water level in the main flow of the Euphrates River because construction of the facilities for the purpose will require a rather large scale of project works, but it appears reasonable and economical in saving O & M cost to construct several weirs and gates on the tributaries and branch streams for securing regulated intake water level.

b) Integration of diversion works

So far as the Mission observed, the volute pumps running by fuel oil have been employed, although several intake devices operated by gravity or

electricity have been seen therein.

The scale of the pumping stations has varieties, large or small, including some stations equippped with pumps with 200 mm bore diameter.

Those pumping facilities have been operated under the administration of respective cooperative unions so that the paddy cropping can be readily available in the effective use of small scale pumping facilities. The selection of pump units, in any case, should be made in consideration of the suitable rate of pumping flow and necessary head to the actualities based on the selection standards.

In veiw of the comparatively small pump head required (1-4 m), short life of pumping units and large amount of running costs, it is deemed economically advantageous to integrate many small facilities into one large-scale facilities on the project basis. Furthermore, a large-scale system of natural water intake will be necessary for future development. In both cases, a careful study will be required for planning the long canal system necessitated, in taking into the account the much water losses by evaporation, percolation and long water conveyance.

c) Irrigation canal lining

It may be reasonable to provide unlined canals at the presnet stage that the losses will be sufficiently supplemented with abundant water, but the unlined canals will necessitate much cost and labor forces for O & M and also bring about water losses and rise of the groundwater table caused by percolation. Such being the case, the earth lining, asphalt lining, etc. should be applied to meet the conditions prevailing therein in taking consideration on advantageous accumulation of the social over-head capital.

d) Small irrigation canals (Ditches)

The irrigation water taken into by pumping or gravity is distributed to each farm lot, and it is considered essential to carefully study the water intake method and the farm size of the lots. Many ditches branch from the irrigation canals to irrigate each farm lot: there are several canals branching more than 10 ditches within a hundred meter distance.

The water level is low in the irrigation canals, which run at compara-

tively high elevation, and the ditches are excavated deep. The elevation difference between the embankment with excavated earth and the canal bed measures more than two meters, which compels farmers to shoulder the heavy burden of labor.

In order to improve the situations, there are several ways such as raising up the water level by filling the canal bottom with earth, provision of check devices and side canals, or pumping up the water. The improvement of the ditches as well as the land consolidation, which is mentioned below, will alleviate the farmers' tough labor, increase cropping acreage, and make effective water management possible. Such improvements are expected to produce good effects worth while, if realized.

e) Land consolidation

At present, the man-power levelling has been carried out after plowing with tractors, and ridges in the farm lots have been created by hand-work in the location corresponding to the conditions of farming practices, land-ownership and flooding irrigation water. However, the improvement in the ridge creation should be made for introducing farming machines and other betterment of farming works. Tilling by tractors, which has alleviated farmers heavy works, cannot allow to do the dose-grained levelling works and cause unevenness of the land surface which has resulted in uneven flooding of irrigation water. Such uneven irrigation has produced adversely effect to growth of plant and yield of crops. Furthermore, irregularity of ridges has made the shape of lots pseudo-morphic and has become a hindrance for introduction of farm mechanization together with requirement for much labor forces in creation of ridges and levelling works.

Being as such, it is considered most effective to formulate the fundamental land consolidation plans including re-arrangement of irrigation and drainage canals in the fields so as to increase yield and save labor and costs. This land consolidation program will be applicable not only to the areas surveyed by the Mission but to the whole paddy cropping areas in the country.

The impelentation of land consolidation requires prior studies and

comprehensive considerations in such details as water management, drainage control of surface water and groundwater, salinity control, type and size of farming machines, varieties of crops, farming practices, farm management, topography and soil properties. For successful implementation, it is recommended to set up a pilot farm for trial cropping. Although it will be not practical to directly apply the land consolidation which is now being carried out in Japan, it may be usefully introduced with necessary modification according to the conditions in Iraq

In Japan, the topographical conditions resyrains to provide the large-scale farm block, but in Iraq the larger block will be available.
The general idea for land consolidation in Japan is illustrated bellow following page.

(For illustration)

i) The unit farm land in the land consolidation is a plot, in which sometimes small temporary ridges may be provided to partition into smaller pieces of farm lots so as to keep the irrigation water even in depth or to make the boundaries clear based on the land-ownership.

ii) The plot, usually called "block", is the unit farm land being bounded by farm road, irrigation and drainage ditches, and ridges. In Japan, most of the plot (block) has about 30 a (100 m x 30 m), depending upon capacity of farming machineries, effectivenes of land levelling, and type of farm management. From the economical viewpoint, the width of plot (short side of plot) should be taken in parallel with the direction of topographical inclination. The plots should provide the irrigation and drainage ditches and farm road along its width sides.

iii) The farm land block is those lands consisting of several pieces of plots and bounded by farm roads, irrigation and drainage canals. The farm land block is formed in due consideration of the general topographical conditions of the area, existing irrigation and drainage system, location of farm roads, etc. The long side of

the said block has 300-600 m length in the permissible range of the irrigation ditch, and the short side has 100 m - 150 m for facili tating the elimination of surface water.

Fig. - 1 Small irrigation canal (Irrigation ditch)

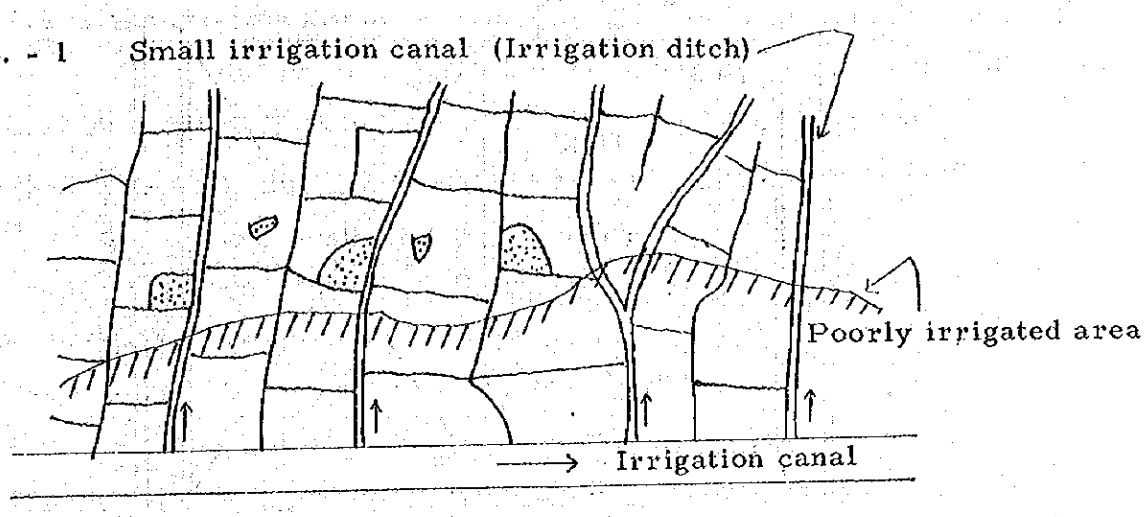


Fig. - 2 Improvement of land levelling will enable to increase paddy yield
Improvement of irrigation canal will increase paddy yield.

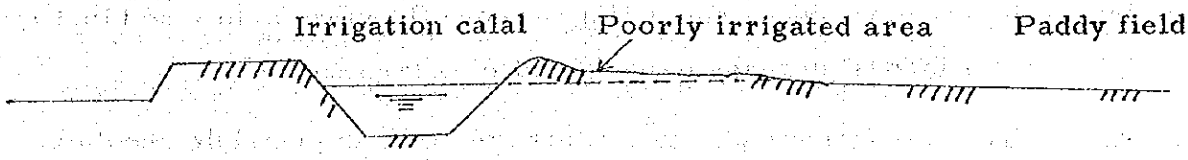


Fig. - 3 Emabankment with excavated earth

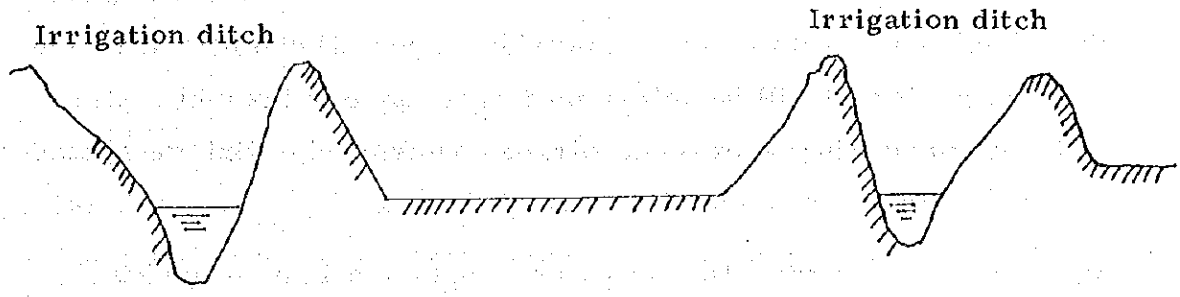
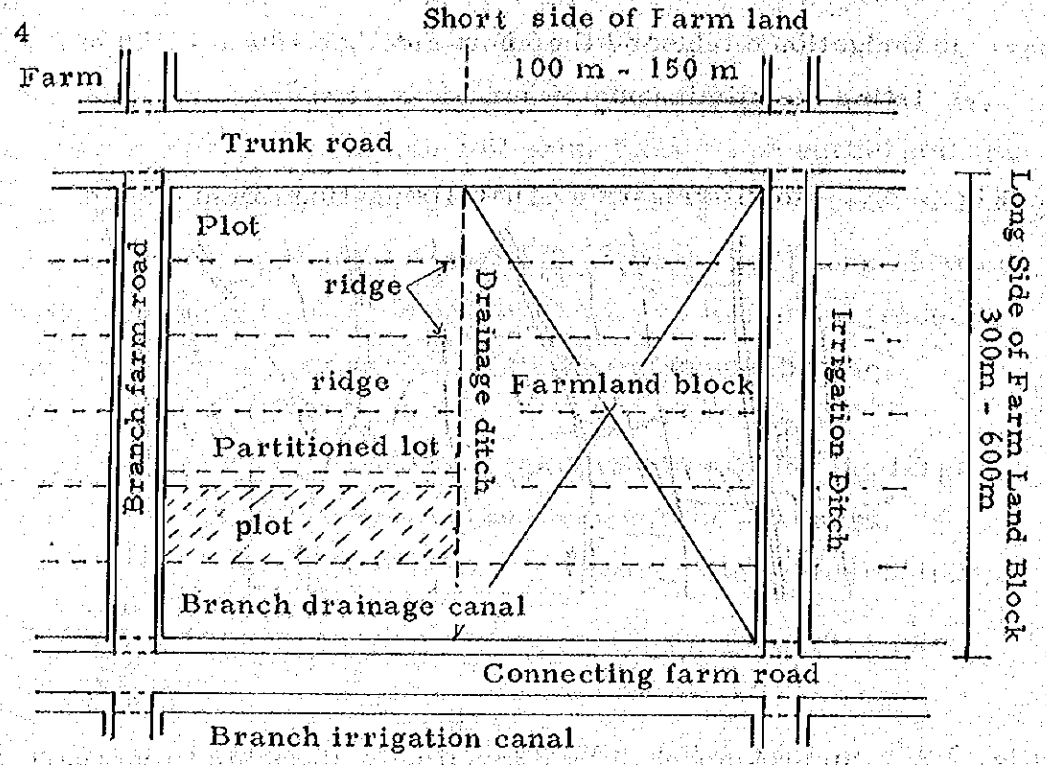


Fig. - 4



iv) The farming block, consisting of more than two farm land blocks, has a largest acreage being bounded by farm roads.

v) The trunk farm roads with two trafic lanes in principle should be arranged in carefully studying the inter-relation among the farms, storage, processing and distribution systems, location of villages, and existing roads.

vi) The branch farm roads are provided along the width of plots and their interval will be determined by the size of the plots. The connecting farm roads will be constructed to link the branch farm roads with each other.

vii) As a general rule, the irrigation canals should be provided separately from the drainage canals so that the water management can be conducted independently in every plot in possibly avoiding the direct diversion from the main and branch canals.

viii) The depth of terminal drainage canals is determined in the range of 0.5 m - 1.2 m below the field surface depending upon the soil

property and groundwater table, and in the case, the length of irrigation ditches should be some 600 m at maximum.

Provision of drainage canals

So far as the Mission surveyed, no drainage canals have been provided for draining out the water in the fields completely. It is vitally important to construct drainage facilities in the low-lying land, although the comparatively high land mentioned above necessitates those facilities as well.

In the marsh lands, transplanting of seedlings, which are grown in high-lying nursery beds, has been carried out with the water level in the marsh lowered, because the timely sowing would be difficult if the sowing is carried out after the water level lowered in the marsh. The transplanting is carried out by man-power. Though the local people show the interest in the Japan-made rice planters, it will be fundamentally required, prior to introduction of such machines, to construct drainage canals, levees, regulating gates, drainage pumping stations, etc. that enable to drain the water artificially. The comprehensive large-scale project should be formulated for realization of the purpose. And establishment of total drainage system, which will allow to reduce the groundwater table, will result in sharp production increase of paddy.

Salinity Control

In order to carry out the rational paddy cropping constantly in the low-lying flat lands with high groundwater table, the provision of drainage canals will be indispensably required for control of salinity concentration in the soils.

A special care should be exercised to the electric conductivity of the irrigation water, because it is reported that it rises more than 800 micro mhos/cm in the low water season. But the Mission surveyed it by 500 micro mhos/cm, reasonable value, in the high water season. Besides the above, since the salinity concentration is high in the groundwater and the marsh, the poor drainage is expected to cause accumulation of the salts in the soil.

3-4 Expansion of Paddy Cropping Acreage

The preceding paragraphs describe the improvement method of the existing paddy fields. And blessed with dazzling sunshine, vast flat lands and abundant water, Iraq has enormous potentiality to increase rice production in the future. The positive promotion of improvement of existing paddy fields will be the most effective and solid approach envisaged to rice production increase.

However, the yield increase in the existing paddy fields will have to reach the limit and it is necessary to basic study to seek for the way to expansion of the acreage of paddy fields against the case.

The areas available to reclamation for the paddy fields will be those which extend in the riparian low-lying plain and comparatively high-lying lands in the marsh. Iraq is promising to provide a vast area to be reclaimed so far as the water sources may be secured, although expected total acreage of lands for further development should be estimated on the detailed topographical maps.

a) Development of low-lying plain along the rivers

Expansion of paddy cropping acreage will require to prepare detailed topographical maps, soil maps, etc. as basic data and information, on which study and survey shall be conducted for selection of suited lands to paddy cropping, and plan formulation of irrigation and drainage systems available. It will be also necessary to prepare the master plan on irrigation and drainage based on the potentiality of the main rivers as water sources.

b) Development of marsh lands

The water in marsh is considered unsuitable to the irrigation water due to high concentration of the salinity. The marsh land itself, however, has several advantageous topographical conditions of development for paddy fields, because the marsh land, vastly extending in low-lying plain, is an area with flooding water around one meter deep and consists of the silty clay soils which will provide the stable base for embankment. Thus, it will be facil to construct the polder dikes two or three meter high for keeping a certain area from the outside water, and the inside water shall be drained out by pumping after conveyed through the drainage canal.

The irrigation water shall be introduced from the rivers to make the areas developed for paddy cropping.

It will be possible to materialize the comprehensive development project of the area in future by providing pumping stations and gates in the estuaries.

The technology of reclamation, which has been already developed, is applicable to the project, and uncomplicated as compared with those applied to the sea reclamation in the Netherlands and Japan.

CHAPTER IV. FARMING TECHNIQUES

4-1 Present Cultural Methods and Related Problems

Rice Culture in Iraq is characterised by the direct sowing method in contrast to the transplanting method practiced in Japan and other Asian countries. Transplanting is practiced in Iraq only in marshy areas where water is too deep at the time of sowing, but requires more labor. In Japan, where transplanting is predominant, direct sowing is also practiced in some areas where labor is unavailable at the time of transplanting. The rice area under direct sowing in Japan is about 50,000 hectares which is only a few percent of the total rice cultivated area but about equivalent to the total rice area of Iraq.

The yield obtained by direct sowing method in Japan is almost equal to that of transplanted rice, although it does not reach the highest yield of transplanted rice i.e., 12 ton/ha. The results of research and experiment, as well as the trials by farmers, on increasing yield of direct sown rice would be useful to improve the rice culture in Iraq.

There are two types of direct sowing method; the one is sowing on non-flooded land and the other is on inundated land. Both types are practiced in Japan but the former type gives better yield. The dry sowing has various advantages over the sowing on inundated land. Mechanisation of sowing operation is easy for the former type. Line sowing is possible only for the former type. Since, however, complete water control is the essential pre-requisite for the dry-sowing method, this method may not be practiced commonly in Iraq under the present conditions of irrigation and drainage facilities.

Direct sowing on inundated land has the disadvantage of poor germination and lodging. Irregularity of germination and plant growth due to the uneven deapth of water is widely observed. Better leveling before inundating land is essential. Use of machines for leveling would be one of the most important and effective measures for increasing yield in Iraq.

The plants sown in inundated land are liable to lodging, because the seeds are placed on the surface of the soil instead of being covered. A device has recently been developed in Japan to eliminate this defect of sowing

in inundated land. The method consists of coating seeds with calcium deoxide (Ca Co_2) and putting the seeds under the surface soil (1-2 cm deep) by the use of specially designed machine. The seed germinate with the supply of oxigen from the decomposition of the coating chemical and develop roots deep into the soil. This device might well be tested in Iraq.

4-2 Varieties

The rice variety most popular in Iraq is Amber, a local variety of good taste. Although high yielding varieties such as IR-28 are also grown, farmers prefer Ambar because of its quality and higher price. This is similar to the situation in Pakistan.

Pakistan is known as the country where "Green Revolution" progressed rapidly with the use of high-yielding IR varieties. Yet farmers grow Basmati rice, a local variety of high quality, as far as the natural conditions permit the cultivation thereof. Hence, the adoption of IR varieties is limited in the southern part (Sind State) where Basmati can not be grown due to the hot and dry condition.

These facts seem to indicate that the selection of varieties to be recommended to farmers should not be made only from the yielding capacity but quality has also to be taken into account.

Resistance to high temperature and dry conditions will be an important agronomic factor for selection of varieties particularly in Iraq. According to the experiment conducted at Diwaniya Experiment Station as early as in 1956, high temperature and aridity in flowering season induce sterility and reduce the yield. And it was also found that there was a considerable difference among varieties in this respect (Note 1). For example, Basmati introduced from Pakistan showed as high sterility rate as 75%, while the sterility rate of Kyudai Asahi No. 3, a salinity resistant variety introduced by Dr. Ito from Japan was only 16% which was lower than that of local varieties (Note 2).

Recently, the International Rice Institute (IRRI) conducted research on this problem with the use of phytotoron and identified the varietal difference of tolerance to hot and dry conditions in flowering season. The examples are shown below (Note 3).

	Fertility (%) at high temperature
Tolerant	
Agbede	88
Carreon	90
Dular	86
N22	92
OS4	86
PI 215336	88
Sintiane Diofor	86
Susceptible	
Basmati 370	4
BKN 6624-46-2	3
C4-53G	8
H4	2
Pelita 1/1	7

Note 1. Chao Ling-Fang, Report to the Government of Iraq on Rice, No. 1081. FAW 1959.

Note 2. Dr. Hiroshi Ito, Rice agronomist served for Iraqui Government in 1962-63. Presently Professor of Ishikawa Agricultural Colledge.

Note 3. The International Research Institute, Annual Report, 1975.

Apart from the use of torelant varieties, the hazard of hot and dry condition at flowering stage might also be avoided by earlier or delayed sowing. Study on micrometerology of rice field such as conducted by Dr. Ito would also be useful for devicing measures for alleviation of heat and dry hazard. Plantation of dates or other trees around rice fields as windbreak has the effect of reducing temperature of the rice fields. It is worth noting that, according to Dr. Ito's observation, temperature is lower and humidity is higher in the rice field of larger size than those in separated small fields.

4-3 Soil Improvement and Fertiliser Application

The improvement of salinity-concentrated soil is such an important problem for the agriculture in arid zones that the soil improvement tests and

upbringing of specialists in the line are urgent matters to be realized. On the other hand, the conventional farming practices should be re-studied in consideration of that the farmers have experience to some extent in the improvement of the saline soils.

Although experiments on soil and fertilizer are carried out in some extent at Najaf Rice Experiment Station in connection with varietal test, more study should be made on soil, especially saline soil, and the proper amount and method of fertiliser application.

At the same time, soil survey and classification should be conducted covering as large area as possible so that proper varieties and cultural methods suitable to the soil conditions may be taken. The importance of soil survey was stressed by Dr. P. Buringh as early as in 1960 (Soil and Soil Condition in Iraq, 1960).

4-4 Study on Present Farming Practices

The rice producing areas of Iraq extend widely and there are considerable local differences in water availability, soil conditions, labor availability and other conditions. Farmers practice conventional methods which have been developed and inherited for centuries according to the respective local condtions.

It is important for planning production increase in the respective area to study and analise these conventional methods in the light of modern science.

In many cases, conventional methods can be scientifically endorsed under the given conditions of the area. For example, interval irrigation of three days inundation followed by three days drainage practiced in Abushoot village, Missan Province, has the effect of enriching oxigen in the soil and activate respiration. This is an advanced method practiced also in Japan with good result. It must be noted, however, that such an advanced method requires careful water management. Otherwise it would result in decrease in yield. In fact, the Team observed in some other areas excessive interval drainage with withering plants.

4-5 Seed Multiplication and Distribution

There neither seems to be the system established for multiplication

and distribution of certified seeds of specifically recommended paddy varieties, nor provided for the registration of breeders and their quality control. It is essentially required that the Government provides the integrated system of the above-mentioned, from multiplication to distribution including the technical guidance.

4-6 Other Agriculture Supporting Services

a) Improvement of agriculture extension service

The collective production and farm mechanization operated by the agricultural cooperative, which is the core of the Government policy of agriculture, may bring a great change to most of the farmers who have been individually exercising the conventional and simple farming practices with primitive implements, spades and hoes, for their self-sufficiency. In order to follow such an change, it will be urgently required to properly educate the farmers and to bring up the local leaders.

In the Missan province, the National Institute for Agricultural Technology has been giving the necessary education to those who are graduates of high schools so as to bring up the senior leaders. It is deemed necessary, besides the above, that the general but extensive guidance and training shall be given to the key staff of the cooperatives and the core farmers as leaders so as to have understanding on the Government policy, intention to the agriculture, the outline of the Projects, and farming techniques.

Particularly, it is absolutely important to establish the system for educating younger generation on latest scientific knowledge. Increase in number of extension workers who are the college or university graduates and provision of various facilities and equipment for activities will be required for the purpose.

4-7 Pilot farm

A pilot farm (30 ha in size) for paddy cropping should be provided so as to materialize the above-mentioned plans in showing comprehensive paddy cropping techniques to the local farmers.

The pilot farm aims to establish the standardized and mechanized

paddy farming along with the direction of the Iraqi Government and to provide the irrigation and drainage facilities, farm roads, land consolidation, and other related buildings and structures.

Simulatenously, the pilot farm shall provide the lodging accommodation, lecture hall and class rooms for farmers to receive the practical training and education.

CHAPTER V. FARM MECHANIZATION

Iraq, blessed with a vast plain and abundant irrigation water, has executed the agricultural land reform and created the new farmers' organization. The farmers are eager to introduce the farm mechanization for which the Government is taking the positive policy to meet the requirements.

The labor force, which have been declining in number, will be further shortened in future. The timely and intensive farming works will increasingly require farm mechanization for yield increase and expansion of cropping acreage.

5-1 Promotion of Farm Mechanization

a) Preliminary survey

There are so many items to be surveyed prior to implemenation of farm mechanization, particularly special attention should be paid to the following metters.

i) Conditions of paddy fields
- Physical propoerties of soil
- Conditions of sub-surface layer
- Groundwater table
- Water Utilization

ii) Facilities
- On-farm facilities
- Warehouse
- Repairshop

iii) Farm practices
- Farming method
- Working period

iv) Conditions of farm management
- Size of farmers' group
- Cropping acreage
- Operators of farming machines

v) Others Distribution of products

b) Experiments and extension services

The results of prior surveyings as above will allow to make up a provisional mechanization program, including selection of machineries suited to the local conditions. Trial operations of the machines shall be executed to establish the appropriate farming method, which shall be extended to the farmers.

It is natural that the improvement of the technique should be tried positively in the pilot farm so that the better mechanization system may be firmly established.

As a general rule, the concrete farm mechanization system should be established in following the above-mentioned procedures. In the current status of the area, the provisional mechanization program as below is recommended in consideration of the various field conditions prevailing therein.

The one is to introduce small-size machines suitable to the present small-size farm lot for primary improvement and this will be applicable to the farming by individual farmers or by small-scale cooperatives; the other is to introduce large-size machines to the farm lots after implementation of the land consolidation.

These two approaches will be further divided by ways of sowing and planting into the following methods as illustrated.

Mechanized Farming	Farming with small-size machines	Dry fields	Direct sowing
		Flooded fields	Direct sowing
			Transplanting
	Farming with large-size machines	Dry fields	Direct sowing
		Flooded fields	Direct sowing
			Transplanting

Note:

Direct sowing in dry fields

This is most suitable to mechanized farming.
The fields should be in dry conditions and the soil should

be harrowed to the minimum extent.

Direct sowing in flooded field

The soils shall be harrowed in flooded condition, when harrowing difficult in dry field condition

Transplanting in flooded field

This is applicable when the cropping period is rather short due to double cropping or diversified cropping. The well-managed water control is essentially required for transplanting and field surface should be levelled evenly.

5-2 Mechanized Farming with Small-size Machines

The employment of small-size machines is recommended for small farm plots with considerably solid foundation, excepting for marsh lands, where no large-scale land consolidation is expected for quite some time to come. In the case, the slight adjustment of the farm lots and providing access roads for machines will readily enable to realize farm mechanization.

a) Arrangment of farm lots

The following minimum arrangement of farm lands is required for introduction of farm mechanization with small-size machines.

i) Arrangment of farming block and levelling - one block should be in the range of 0.5 - 1.0 hectare.

ii) Integration and rationalization of irrigation and drainage system

iii) Construction of access roads for small tractors

b) Farming practices

i) Farming by small-size machines in direct sowing in dry fields

Works	Machines to be used	Working efficiency (are/hour)
Levelling	Tractors with earth-moving blade	
Plowing, Fertilization & Sowing	Tractors (15HP or 20HP) Double shaft drive Attachment: Drive harrow (mounted) Grain-drill (mounted)	13
Tamping	Cultipacker	30
Top-dressing	Hand-sprayers	30
Harvesting (threshing)	Self-threshing combine (wide crowler type)	7

Note: When the soil is so hard to be difficult in plowing, fertilization and sowing, plowing by rotary-plow should be employed before plowing.

ii) Farming by small-size machines in direct sowing in flooded fields.

Works	Machines to be used	Working effeciency (a/hr)
Ridging	Ridging machine	30
Plowing & harrowing	Tractors (15 HP) Double shaft drive with rotary plow	13
Fertilization	Broadcaster (or hand broadcast)	20
Paddling	Tractor (15 HP) Double shaft drive with paddy harrow	30
Sowing	Hand-broadcaster	30
Supplemental sowing	By man-power	30
Top dressing	Sprayer	30
Harvesting	Harvester and binder (2 rows)	7
Threshing	Automatic thresher	12
	(or Self-threshing combine)	(7)

Note: i) Tractors for wet paddy field type shall be used.

ii) Supplemental sowing shall be made only for the parts of the field with germination poor.

iii) Farming by small-size machines in transplanting in flooded fields.

Works	Machines to be used	Working effeciency (a/hr)
Ridging	ridging machines	30
Plowing & harrowing	Tractors (15 HP Double shaft drive) (with rotary plow)	13
Fertilization	Broadcaster (or hand broadcast)	20
Paddling	Tractors (15 HP Double shaft drive) (with paddy harrow)	30
Raising seedling	Raising of matt seedling in nursery bed	10
Transplanting	Transplanters for two rows	10
Top dressing	Broadcasters	20
Harvesting	Harvester and binding machines (two rows)	7
Threshing	Automatic thresher (or self-threshing combine)	12 (7)

Note: For paddy fields which are poorly irrigated due to high elevation, a small type vertical pump shall be employed for supplementing the water.

iv) Notes

- In direct sowing in the dry fields, levelling works shall be implemented before plowing.

  In direct sowing in the flooded fields, levelling works shall be implemented with levelling plate attached to the paddy harrow; especially in considerably undulated fields, levelling works shall be made by a tractor with rotary plow attached, in driving backward.
- Plowing, when difficult due to hard earth, shall be implemented in the time when the soil contains proper moisture, or implemented after once the fields irrigated and drained to keep the soil moisture contents moderate.
- In paddling, floating shoes should be attached to the ordinary wheels, if the tractor runs deep due to soft soil.

- o When transplanting, the nursery beds should be provided possibly close to the paddy fields. The seedlings should be transplanted with planters by mat method.
- o Non-shattering paddy varieties will be favorable in using the harvester and binder when harvesting.
- o The portable pump shall be carried by boat transporting through main canals when necessity happens.

5-3 Farming Works with Large-size Machines

Employment of the large-size machines requires the proper plot size arraged by land consolidation so that the machines can operate in high efficiency, and these machines are applicable to the farming practices to be carried out in state farms or large-scale cooperatives' farms.

a) Consolidation of agricultural infrastructure

The consolidation of agriculture infrastructure, which needs a large investment, should be executed according to long-range program on the basis of the master plan prepared by the Government. It is necessary to conduct detailed surveys and investigations for successful implementation.

i) The farm block should have an acreage ranging 2.5-3.0 hectares, which will be determined depending upon capacity and efficiency of the machines available, rationalized water management, and various factors in irrigated conditions of the fields.

ii) There should be such facilities provided as bridges, farm roads, access roads to farm plots and rice mill.

b) Farming practices

i) Direct sowing in the dry fields in employment of large-size farming machines.

Works	Equipment to be used	Working efficiency (a/hr)
Grading	Tractor (75 HP) with earth-moving blade	
Plowing	Tractor (75 HP) with rotary plow	25
Preparation of seeds		
Harrowing, levelling, fertilization & sowing	Tractor (75 HP) with drive harrow & broadcaster of seeds and fertilizer	20
Tamping	Cultipacker	30
Top dressing	Light air plane with broadcaster	5,000
Harvesting & threshing	Combine for paddy (width 4 m)	23
Hauling	Trailer	

ii) Direct sowing in the flooded filed in employment of large-size farming machines,

Works	Equipment to be used	Working efficiency (a/hr)
Plowing	Tractor (75 HP) with rotary plow	23
Paddling	Tractor (75 HP) with drive harrow or paddy harrow	100
Fertilization	Light airplane with broadcaster	5,000
Preparation of seed & sowing	Light airplane with broadcaster	5,000
Supplemental sowing	Broadcaster	
Top dressing	Light airplane with broadcaster	5,000
Harvesting & threshing	Combine for paddy (width 4 m)	23
Hauling	Trailer	

Note: Supplemental sowing shall be made only for the parts of the field with germination poor.

iii) iii) Transplanting in the flooded fields in employment of large-size farming machines;

Works	Equipment to be used	Working efficiency (a/hr)
Plowing	Tractor (75 HP) with rotary plow	23
Puddling	Tractor (75 HP) with drive harrow of paddy harrow	100
Fertilizer	Light airplane with broadcaster	5,000
Raising of seedling	Raising in nursery bed in mat method	
Transplanting	Man-drive type planter (6 rows)	25
Top dressing	Light airplane	
Harvesting & thresing	Combine (width 4 m)	23
Hauling	Trailer	

iv) Notes

- o For the flooded fields, the tractors for wet paddy fields should be used.
- o Combines for paddy should be used and those equipped with wide catapilar type self-thresher should be employed, if difficult in operation due to soft ground.
- o In paddling, floating shoes should be attached to the ordinary wheels of the tractor.
- o The rotary plow will enable to plow more evenly, whereas the disk type will plow unevenly.
- o When the pest and weed controls are required in future, the necessary chemicals shall be broadcasted by light airplane.
- o Harvested paddy shall be hauled directly to silo.
- o Regarding plowing and paddling, refer to the preceding paragraph about the farming practices with small-size machines.

5-4 Summary

a) The systematic farming practices with large-size machines should be established in the fields one after another, where the consolidation of

agricultural infrastructure will be completed. Such consolidation together with timely execution of farming practices as well as expansion of actual cropping acreage will result in paddy production increase. Even in the fields that the consolidation will not be anticipated in the near future, the introduction of mechanized farming with small-size machineries will enable to increase paddy production.

b) The Farming Machinery Station, National Farms, and Cooperatives are expected to provide the necessary machineries for their best utilization so as to promote the farm mechanization. The Farming Machinery Station will require to provide the capacity to control the stock pile of the spare parts and to repair the machines.

c) The Government should educate and train the machine operators, repair technicians and managerial officials.

d) In the pilot farm, the following major items should be studied in trials for establishment of mechanized farming system; establishment of working method, preparation of standard of farming practices, improvement of the operation and maintenance.

5-5 Introduction of Planters

In response to the request for introduction of Japanese made planters (Transplanting machines), the outline of the machines are described as follows, taking a typical model as an example.

a) Transplanting method

The most practical and popular transplanting method in Japan among many, is the mat-seedling method of young or medium-grown seedlings.

The seedlings are raised in the rectangular mat-form with 60 cm long side and 30 cm short side to be put on the machines for planting.

The followings show the size and quantity of the seedlings required for operation of planters.

	Numbers of seedling mats per hectare	Plant height	Number of blades
Young seedling	200 - 220	10 - 15 cm	2 - 3
Medium-grown seedlings	320 - 340	15 - 25	3 - 5

The spacing of the rows is in a range of approximately 28 cm to 30 cm in considerably dense planting in the lines, 13 cm - 18 cm, which results in the planting density by 22 - 28 plants per square meter.

b) Planters

The planters are classified into two types; manpower-drive type and motor-drive type. The manpower-drive is sub-classified into three; two row planting, four-row planting, and eight-row planting, among which the two-row type is more popular in Japan. The motor-drive type is equipped with six- and eight-row planting device.

Specifications

i) Manpower-drive two-row planting machine

Name: Kubota planter

Type: SPS-28

Measurements

Length: 1,750 mm

Width: 860 mm

Height: 825 mm

Weight: 60 kg

Capacity: 1.0 - 1.5 hr/10 a

Planting method: two-row planting method

Planting speed: 0.6 m/sec

Plant number: 3 - 5 plants/planting (changeable)

Planting desity

Distance between rows 28 cm

Distance between plants in the line 16 cm

Number of hills per m^2. 20 hills

Engine

Type:	Forcible air-cooling two-cycle mono-cylinder
Exhaustion Capacity:	36.5 cc
Maximum Output:	1.7 HP, 6,500 rpm
Fuel consumption rate:	400 gr/psh
Starter:	Recoil Starter

ii) Motor-drive six-row planting machines

Name:	Motor-drive planter
Type:	B5,000 x SPR600

Measurements

Length:	2,980 mm
Height:	1,800 mm
Width:	2,090 mm
Weight:	530 kg
Capacity:	20 - 30 min/10 a
Driving system:	4-wheel float-rove drive system
Variable pitch:	Two shifts for planting Six shifts for driving (including shifting for planting) Two shifts for backward drive
Planting mechanism:	Gold fingers (pushble fingers)
Planting speed:	Foward: two shifts (33.9 m/min) P.T.O.: One shift (0.56 m/sec)
Number of seedlings per planting:	4 - 5 seedlings (changeable)
Freequency of seedling pick-up:	18 - 26 times

Planting desity

Distance between rows:	30cm
Distance between plants in the line:	13 cm or 16 cm
Number of plants per square meter:	20 - 29 plants /m^2

Seedlings required

Young seedlings:	200 - 220 mats of seedlings /ha.
Medium growing seedlings:	320 - 340 mats of seedlings /ha.
Loading capacity of spare seedlings:	22 mats of seedlings

Mounting method: Two link mounting method

Engine

Type Z500 ..... Vertical type water- cooling two cylinders (1,000 cycle diesel engine)

Exhaustion capacity: 508 cc

Maximum output: 9 HP/3,000 rpm

c) Raising of seedlings

There are two methods for sowing and raising; one is to sow in the wooden or plastic box with bed soils spreaded therein, and another is to sow in the fields where vinyl sheet is stretched with frames put on it and the bed soils, taken from the fields, are spreaded.

The bed soils should be laid 2.5 - 3.0 ccum thick for the sufficient coverage of roots zone of the plants. In the case, the soils should be harrowed and mixed with fertilizers before spreading. Although, in Japan, some manufactures sell the ready-prepared bed soils in mixing with fertilizers for saving time and labor, most of the farmers prepare these soils by themselves in their own way.

An appropriate watering shall be made after sowing.

d) Transplanting

Transplanting will follow paddling and levelling when the surface soil provides adequate hardness to planting the seedlings. If the soil remain too soft for transplanting, the fields shall be left intact up to the soil hardened, or the fields shall be drained out to harden the soil and irrigated again to secure the optimum hardness for transplanting.

The water depth, when transplanting, should be kept in the range of 0 - 3 cm. It is considered reasonable that about 80 percent of the total acreage of the field can be submerged. Naturally, the levelling works should be made as carefully as possible.

The number of plants per one planting will be 3 - 5 plants but can be adjusted to meet the local conditions. Transplanting cannot be executed in deep water fields like marsh lands.

e) Summary

i) The comparison of the working hours in nursery and transplanting

between manpower and machine results in as follows (in Japan).

Manpower	357 hr /ha
Machine (2 rows)	146 hr /ha
Machines (6 rows)	103 hr /ha

ii) There will be less difference of yield between mechanized works and manpower, although the former is advantageous in increase in planting seedling, timely cropping and some other factors.

iii) It is necessary for farmers to learn techniques for execution of mechanized works in nursing and planting.

f) Mowing Machines of Cattails

It was requested to introduce mowing machines to remove cattails (Typha latifolia) growing in marsh lands. But, there have been no such machines available up to the date. Information will be given when any practical machines be developed in the future.

g) Small-size cultivators applicable to marsh lands

The machines usable in marsh lands have not been in the market, although it was reported that Chinese had improved some manpower-drive type machines with floating shoes attached, but no detailed information available on capacity, measurements, and others.

Fig. - 5 RICE PLANTER
(TWO (2) ROW)

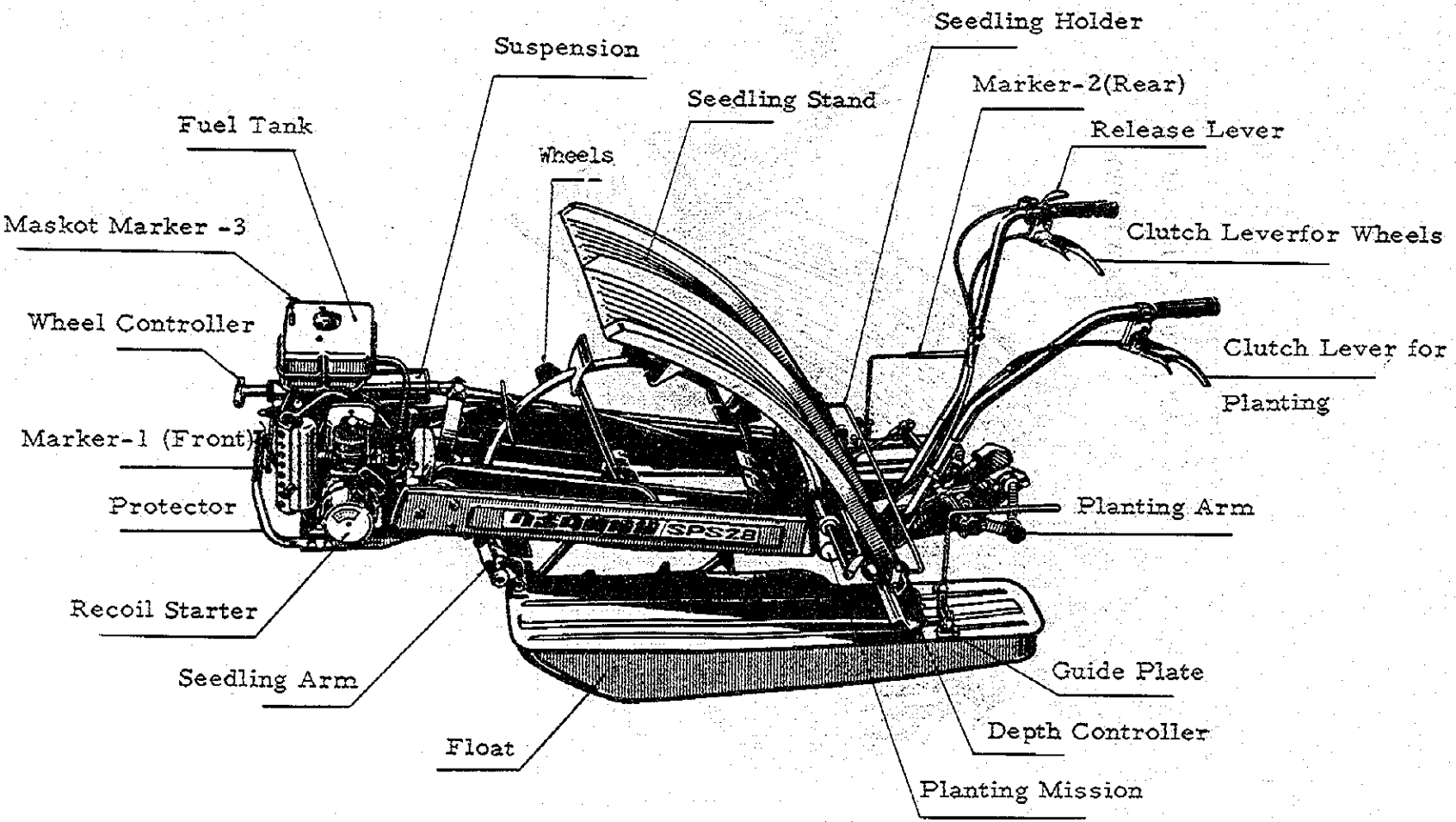


Fig. - 6 RICE PLANTER

(TWO(2) ROW)

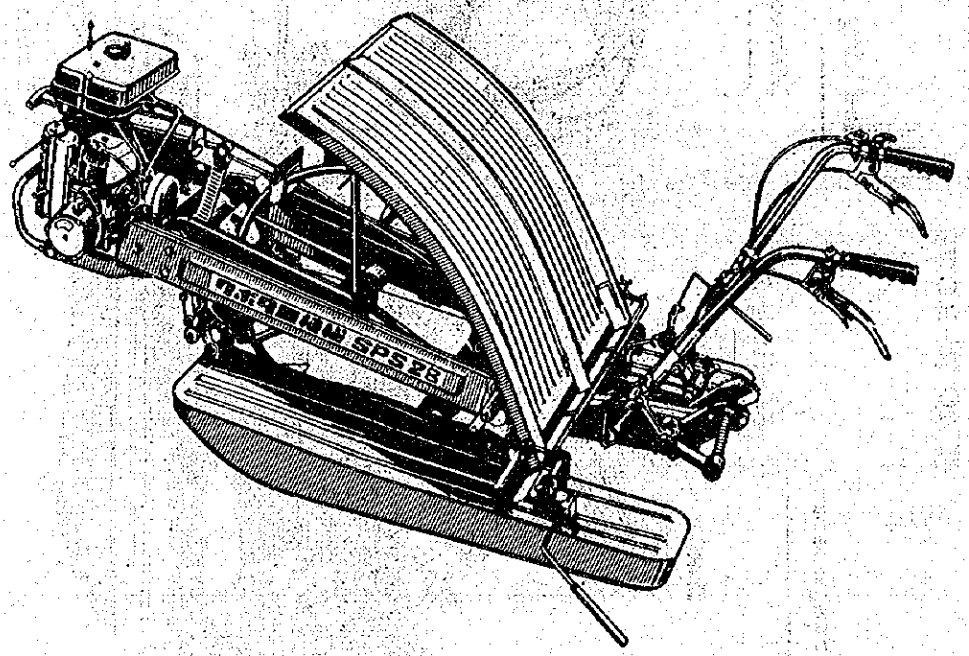
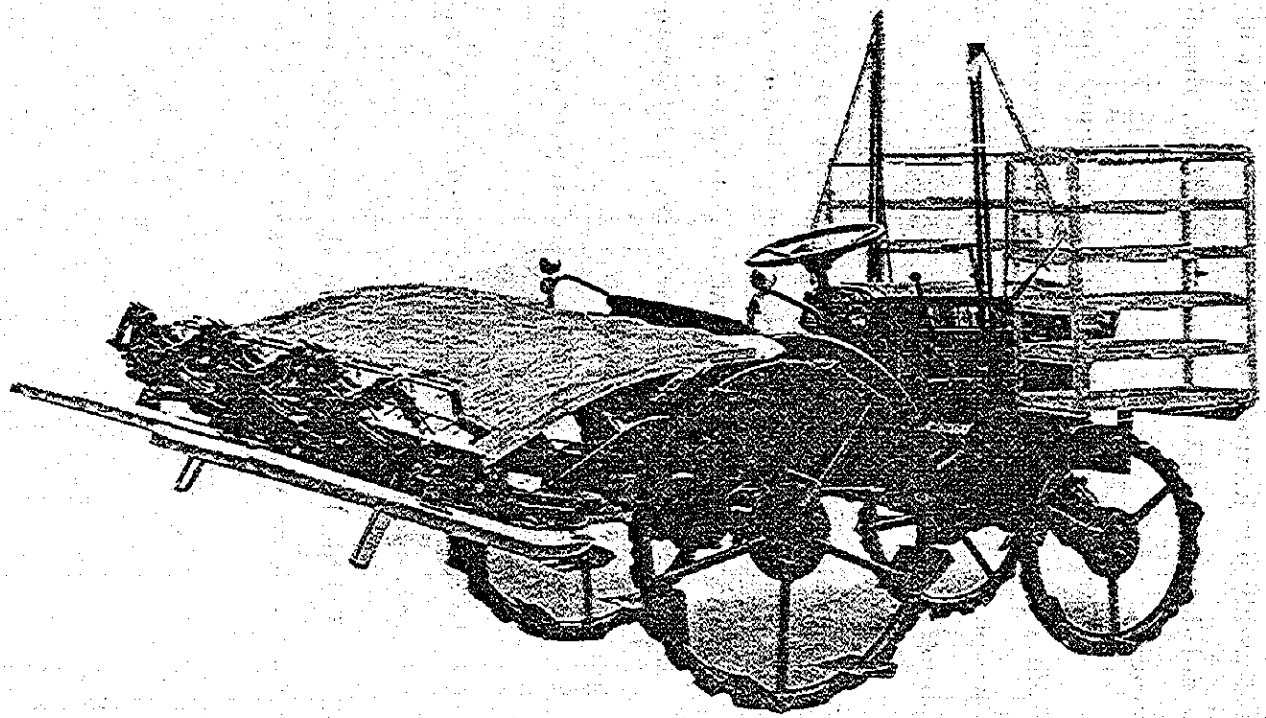


Fig. - 7 MOTOR DRIVE PLANTER
(FOUR (4) ROW)

Motor Driver Planter B5000 x SPR 6000



CHAPTER IV RICE PRODUCTION INCREASE PROJECT

6-1 Mechanism of Rice Production Increase Project

In view of geography and water utilization, the southern part of Iraq is suitable to paddy production. The survey revealed, however, that the means of paddy production, including irrigation and drainage facilities and land consolidation, had been poorly provided, though blessed with natural environment.

The rice production increase cannot be realized only by efforts of individual farmers. In other words, the Government should urgently establish proper policies on the following matters to meet the purpose of such development;

- o to select an area to be developed and formulate the development project under initiative taken by the Government,
- o to place the construction of irrigation and drainage facilities, and their operation and maintenance as a core of the project,
- o to strengthen the cooperatives and promote the rationalization of the distribution system,
- o to provide organization for improvement and extension of the farming techniques,
- o to establish the credit system for farmers to run rational farm management.

Taking into account the above, it is recommended to formulate and implement the Rice Production Increase Project as illustrated in the following charts.

Fig. - 9 RICE PRODUCTION INCREASE PROJECT

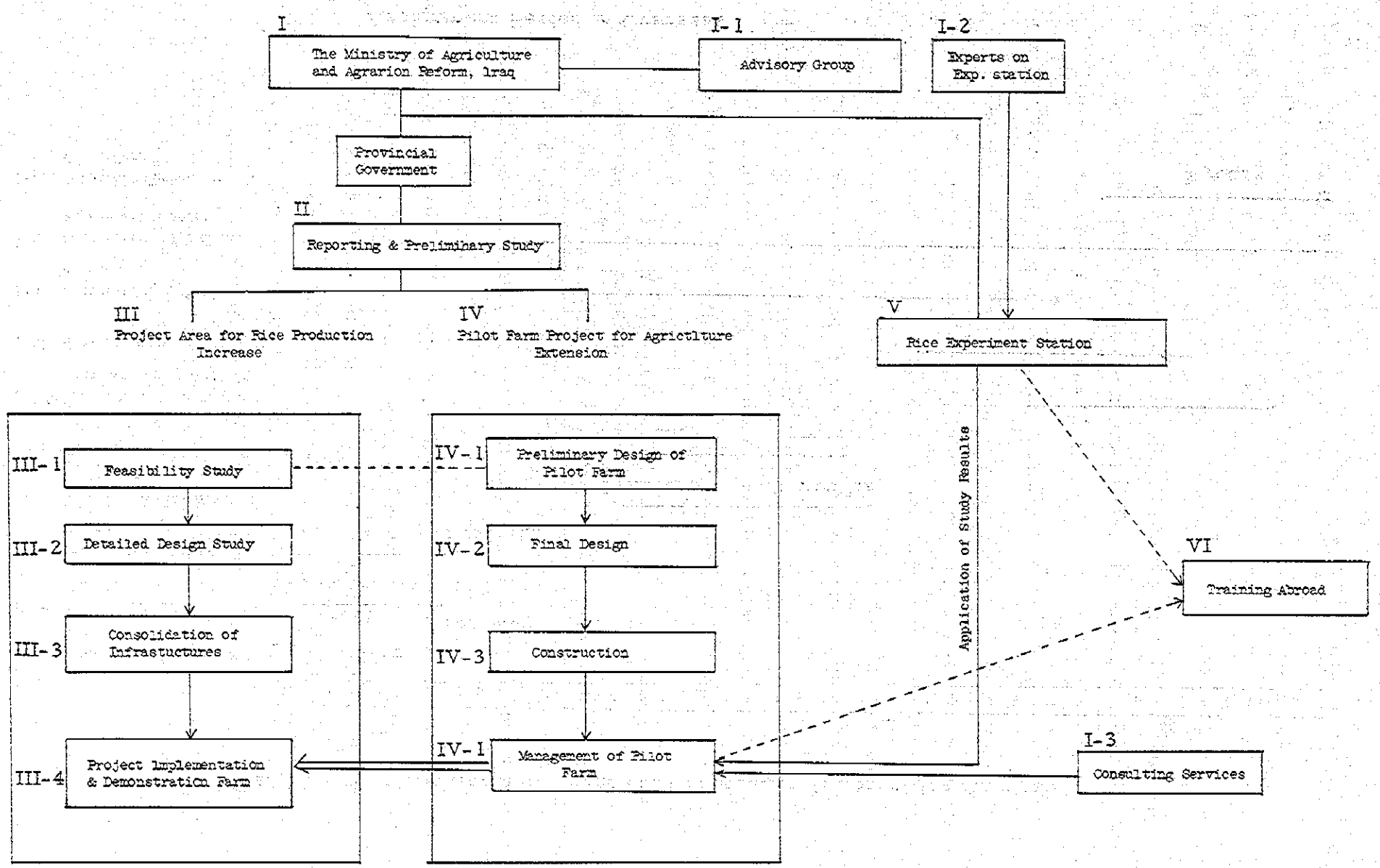
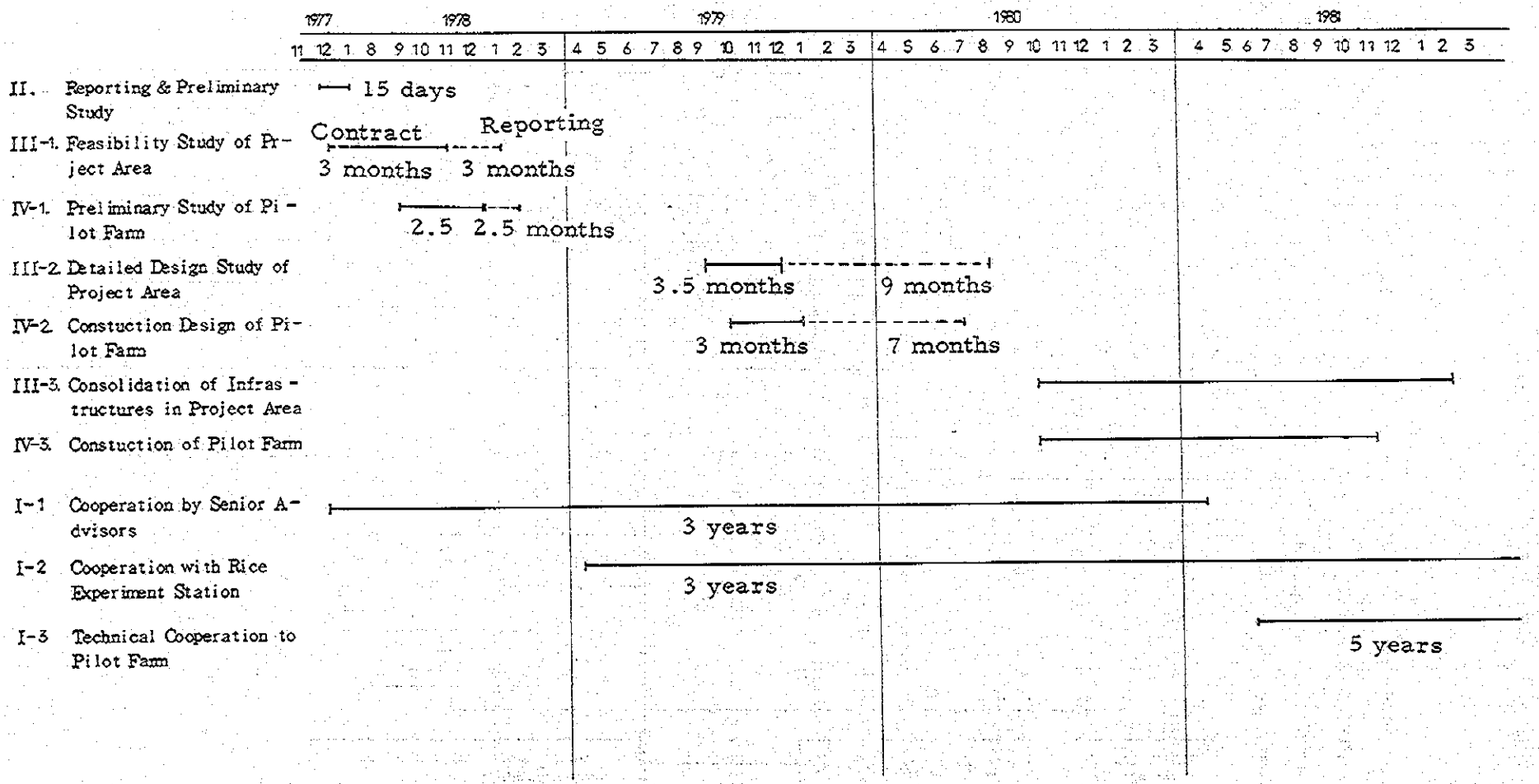


Fig. 10 Work Schedule of Technical Cooperation & Consulting Services



6-2 Explanation of the Project

The components of the Project shown in the above chart are explained below.

I-1 Advisory Group

An advisory group for the Project will be attached to the Ministry for overall planning and administration. The group will include senior advisors from abroad.

I-2 Experts on research and experiment

The experts shall be assigned to give technical cooperation for basic study conducted in the Rice Experimental Station, and it will be decided later by mutual agreement whether several experts shall be assigned alternately in short term or a certain expert shall station throughout the necessary service period in long term.

I-3 Consulting Services for Pilot Farm

The experts shall engage in cooperation in management of pilot farm, improvement of farming techniques, farm mechanization, etc.

II. Reporting and Preliminary Study

A small mission shall be dispatched for selection of the area suitable to the Rice Production Increase Project and the site of programmed pilot farm, concurrently for giving explanation of this report.

The selection and study of the project area and the pilot farm detailed in the following paragraph III and IV respectively, should be carried out as simultaneously as possible. Quick raising of productivity of paddy will desirably require to consolidate the infrastructures in the proposed area and provide the pilot farm within the same area.

The improved or newly developed techniques in the pilot farm will be widely transferred and extended to the farmers in the related areas. The details on survey items are described in the following paragraphs.

III. Project Area of Rice Production Increase

The scale of the project area should be decided on the basis of administrative and natural conditions. The major works to be implemented are to provide and consolidate irrigation and drainage facilities, road networks and so forth.

III-1 Feasibility Study of the Project

The feasibility study of the project includes the plan formulation of the farm management and improvement of farming techniques as well as the basic design of the facilities as mentioned above. The necessary construction cost and the benefit to be created from the farm production shall be estimated to conduct the economic analysis of the project.

III-2 The Detailed Design Study of the Project

The detailed design shall be made based on the sufficient study on the infrastructures of the paddy production.

III-3 Consolidation of Infrastructure in the Project

According to construction plan, the local contractors shall construct the structures and facilities under the guidance and supervision of the consultants.

III-4 Project Implementation

The agriculture infrastructures to be provided in the project area shall be utilized to the maximum extent so as to increase paddy production. The appropriate administrative organization and practically functioning systems shall be established for efficient promotion of the project works; taking example, strengthening of the technical guidance, training and smooth procurement of the input materials would be indispensably required.

IV. Pilot Farm Project for Agriculture Extension

The pilot farm, which will be established in the project area, shall play an important role as the base of the extension of paddy cropping techniques.

IV-1 Preliminary Design of Pilot Farm

The basic design of the pilot farm shall be made in stuying kinds and types of buildings, scale of farm plot and facilities, the farm operation and management and so on.

IV-2 Final Design

The necessary buildings and facilities to be provided shall be designed in details, and the practical plan of farm operation and management shall be formulated in details as well.

IV-3 Construction

The construction works shall be executed according to the detailed design.

IV-4 Management of the Pilot Farm

The pilot farm, which is to be run by the Government, shall provide experts for paddy cropping, operation and maintenance of farming machineries, administration, and other staff, so that they may carry out application study of paddy cropping techniques, their demonstration and farm mechanization for the purpose of levelling up the farming techniques of the farmers in the project area. From various viewpoints as above, it is deemed effective to transfer the Japanese know-how of the paddy cropping.

V. Rice Experiment Station

The Rice Experiment Station shall be established in a site most suitable for conducting various fundamental studies and researches of paddy cropping, so that it can function as a link of cooperative works in the total project in making trials and practices of the study results in the pilot farm.

VI. Training Abroad

It is considered useful that several staff of the pilot farm and the rice experiment station shall be dispatched abroad to receive the training of farming rechniques.

6-3 Selection of the Project Area

a) Selection of the Development Area and Project Formulation

The natural environment suitable to paddy cropping should provide convenience for water utilization, topographical flatness, and possibly low groundwater table. The higher groundwater table will cause emission of hydrogen sulfide which tends to give rise to the root-rot disease of the plants.

Besides the preceding natural conditions, the project area should be selected in consideration of the social conditions such as farmers' population density to make sufficient labor supply available; the thinly populated area will require a transmigration program for full development of the area.

The optimum acreage involved in the project ranges between 10,000 - 40,000 Donum, though varing with the quantity and availability of irrigation water; the optimum acreage of the project should be determined from the viewpoints of effective administrative guidance and water control.

6-4 Consolidation of Agriculture Infrastructures

Somewhere in Iraq, there are various irrigation facilities provided by farmers themselves. Those facilities have,in many cases, been constructed disregarding the civil engineering principle and operated on the basis of their conventional way of life.

The irrigation and drainage facilities should be constructed based on the careful design resulted from prudent calculation so that the facilities will enable to increase labor productivity and land productivity as well as expansion of cropping acreage.

6-5 Strengthening of the Farmers' Organization

Full participation of farmers in the Project Area is essentially needed for the success of the project. Those farmers, taking systematic means of production and distribution, will become a powerful body for production. It is encouraging that most of the farmers have been members of the cooperatives, and the more important thing is that the Government take a policy to lead and train the farmers' organization which can function so

effectively as to increase paddy production. For that purpose, the Government should provide the efficient credit system for the farmers and awake them to establishment of the means of collective works for production and purchase of the related input materials.

6-6 Establishment of Organization for Improvement and Extension of Paddy Cropping Based on the Pilot Farm as Nucleus of Development

The improvement of the techniques shall be made in a pilot farm established in the project area, and the results of improved and applied techniques shall be transferred to the farmers. There are two ways in transfer of the techniques; the one is to directly show the farmers substantial results of the study in a demonstration farm in the pilot farm as well as giving practical training, the other is to reinforce the staffing of the extension staff as well as levelling up the quality of techniques of the staff for giving powerful guidance to the farmers.

6-7 Fund for Farm Management

It is essentially required to secure funds necessary for production and credits for purchasing production input such as fertilizers and farming machineries. The farmers, who have no sufficient fund, cannot increase in production only with their ideas and physical labors.

Following performances will be necessary for paddy production increase:

i) Introduction of superrior varieties
ii) Fertilizer application
iii) Possible mechanization of works
iv) Pest control.

The preparation of these materials and machineries require the well-functioning institution for loan and credit or sometime the lease system of the machineries and equipment. And it is essential that the Government extends the budgetary and institutional support for the successful implementation of the project, although the farmers' self consciousness and effort are inevitably required.

CHAPTER VII. FEASIBILITY STUDY

7-1 Necessity of Study and Approach

The agricultural productivity increase requires to implement the consolidation of infrastructures based on the regional development plan. The first approach to the purpose is to conduct the feasibility study.

The feasibility study, or feasibility survey in other words, shall be carried out in selecting a certain area to be developed, for which the possibility of development shall be studied by evaluating the result of economic analysis on the expected benefit and cost ratio in the development of the relevant area.

The major subjects of the feasibility study are as follows:

i) Natural conditions, especially soil properties, climatic conditions and water utilization conveniency prevailing in the project area,

ii) Whether or not the proposed development plan is acceptable by the inhabitants of the area in meeting their way of life,

iii) Construction plan formulation of irrigation and drainage facilities in seeking the possibly best way to ensure the agricultural development,

iv) Consideration on geographycal conditions, human resources in the area, present land use, plan formulation of farm management, and improvement of farming techniques in taking into account the marketing and pricing mechanism,

v) Necessary measures such as collective works and farm mechanization so as to reach the ultimate goal of production increase,

vi) Plan of establishment of strategic poles (pilot farm and so forth) for improvement of farming practices and upbringing of farmer leaders,

vii) Plan formulation for land consolidation and providing farm road networks,

viii) Establishment of administrative organization for smooth implementation of the project works,

ix) Estimate of construction cost in consolidation of infrastructures, estimate of yields and outputs therefrom, and computation of Economic Internal Rate of Return (EIRR).

7-2 Selection of Project Area

The objective area of the feasibility study should be selected according to the priority for implementation. The area with high priority is the ones which posess the following conditions: a) Although the natural conditions such as topography, water utilization availability and soils, are suitable to paddy cropping, insufficient provision of agricultural infrastructures hinders the yield increase, b) From social viewpoint, rather densely populated rural area requires high productivity of agriculture, c) The farmers have earnest desire to production increase.

Generally, the priority for execution of feasibility study should be decided on the basis of the above factors. The objective acreage of feasibility study in a range from 10,000 Donum to 40,000 Donum will be practically suitable to implementation of the project from feasibility study to construction.

7-3 Plan of Survey

Main items of the survey are specified as follows:

- o to select the areas in the range between 10,000 and 40,000 Donum, and to evaluate technical and economical feasibility for realization of agricultural development project that will be formulated on the basis of analysis and study of the data collected in the field survey,
- o to make the practical implementation schedule of the project formulated in item i) above,
- o to give training to the counterparts personnel assigned to the project at every stage of field survey, plan formulation, etc.

7-4 General Plan of Survey

The services rendered in the Project shall be staged into two as follows:

i)	Field Works:	Field Survey (including data collection)
		Plan Formulation
		Interim Reporting

ii) Home Office Works: Preparation of Draft Final Report

Review on the above by Japanese authorities concerned

Revision of Draft Final Report based on the comments by Iraqi and Japanese sides

Printing and Submission of the Final Report

7-5 Field Works

The field works include items as below in following the process of the works.

a) Data collection and analysis

i) Data collection and analysis of hydrology and meteorology

The data of hydrology and meteorology, in general, should include the long-term records observed in the project area and at the project site regarding water levels and discharges of the rivers, daily rainfall, daily mean temperature, humidity, evaporation, wind velocity and direction, groundwater table, etc.

Furthermore, analysis should be made on the specific data obtained such as flood water level, flood discharge, droughty water level, droughty discharge, silt contents, water quality, maximum daily rainfall, mean daily rainfall, maximum and minimum daily temperature, consecutive drought days.

ii) Data collection on topography and land register

Topographic maps on various scales should be collected as many as possible to select the project area and to make a plan for canal networks. Since the topographic map on the scale of 1/10,000 being used for the study is readily available in the field, therefore, no surveying will be carried out in this study. The data on land register should be collected for the districts where there may exist problems related to land registration.

iii) Soil and soil mechanics

Regarding soil mechanics, pedogenesis, structure, physical and chemical properties of soil in the project area, the existing data available as well as the results of field investigations shall be the

basis of the plan formulation.

iv) Data collection on existing irrigation and drainage facilities
The data should be collected regarding the existing networks of irrigation and drainage, irrigation period, water requirements, irrigation method, conveyance losses, drainage standard operation and maintenance system of the facilities, etc.

v) Data collection on agriculture and agro-economy
The following data in the aspects of the above shall be collected; present land use, farm management, cropping system, cropping items, cropping method, input materials, yields, pricing, distribution, marketing, etc. These data shall be used for studying the problems in the agricultural development as well as for the basis of plan formulation.

vi) Farmers' organization, extension services, farmers education, and experiments
The data shall be collected to study the existing farmers' organization and its activity, actual situation and achievement of the extension services and of farmers education, facilities of experimental station and themes being taken up therein and their results, etc.

b) Field investigation

i) Field survey to decide the project area
Based on the collected data mentioned in section i) several areas shall be selected as proposed project areas, for which the field survey will be carried out to make a final decision of the project area. While the field surveying, a careful study should be made to define the borderline between the project area and others so that the definite acreage of the area can be estimated in further stage.

ii) Survey on water sources
At the water intake point of the project area, the survey will be made on the water level of the river, discharge, water quality, and silt contents in the water, if necessary, so as to have the basis

of the plan formulation.

iii) Route survey of canals

The proposed canal routes, which will be tentatively designed on the maps, shall be confirmed by comparative study with the result of field survey.

iv) Detailed topographic survey

The detailed topographic survey (on the scale of 1/2,500 - 1/1,000) shall be conducted in the construction sites of major structures and the terminal plots for the layout model.

v) Groundwater survey

The comparatively detailed survey on the groundwater in the project area shall be made so as to clarify the groundwater table, its fluctuation and effect to the crops and to serve as the basis of plan formulation.

vi) Survey on land use

Besides surveys of topography and soil distribution, the field survey shall be carried out on physical and chemical properties of soils, and present land use resulted from topographycal conditions in the project area. The relevant survey results will be used as the basis of plan formulation of the land use program.

vii) Survey on farm plots

Since the farm management and yields are affected by land consolidation status of farm plots, the detailed survey shall be carried out to select 50 ha as model area on the present status of the plots. The survey items will be topographic survey, present land registration, existing water distribution system, present land use, yields of crops, etc, the results of which will be the basis of design of the farm plots.

viii) Survey on irrigation water requirements

According to the cropping pattern to be applied to the project area, the water requirements shall be determined by estimating water requirements in depth, percolation and evapotranspiration.

ix) Survey on drainage

The field survey shall be made on the present drainage conditions, sources of the suprlus water, reasons of poor drainage and possibility of drainage improvement.

x) Survey on desalinization

In taking consideration that there may be salinity accumulation found in certain places of the project area, the salinity survey (kind of saline, concentration degree, etc) shall be made to seek for measure of desalinization.

xi) Estimate of construction cost

It is required to check the local condition of supply of construction materials, present status of holding construction machineries to be mobilized, availability and ability of contractors and related basic unit costs to the above so that the estimate of construction cost and planning of construction works can be made.

xii) Survey on farm management

The survey shall be made on the scale of farming, cropping pattern, cropping items and habitual farming practices, input materials, farming equipments and tools currently employed, labor forces, crop yields, rice-milling and other processing facilities, distribution system, marketing, extension survices and education, cooperative organization, so as to establish the plan of agriculture development.

xiii) Farming machineries

As improvement of the farming equipment is one of the key points of the agricultural development in the project area, the survey shall be made on the following items; kinds, types and number of equipment, their ownership, and actual situation of operation and working efficiency, and so forth.

xiv) Economic survey

Farm income in the project area and the economic environment shall be clarified for the economic evaluation of the project. The survey shall be made mainly based on the statistical analysis and

the intensive method may be applied, if necessary, for getting possibly highest preciseness.

c) Plan Formulation

Based on the collected data and survey results specified in section a) and b), the following subjects shall be studied to make plan formulation of the project.

i) Decision of project area and its planimetry

The local conditions in the aspect of technology and socioeconomy shall be studied for respective proposed areas so as to decide the project area with total acreage of 10,000 - 40,000 donum, and the irrigation system wise planimetry shall be made to establish the basis of the estimate of project cost and the economic evaluation.

ii) Irrigation scheme

The irrigation scheme of the project area shall be made based on the cropwise calender, cropping pattern, and related water requirements. Then, the seasonal water requirements will be computed to ensure the water sources to meet the requirements. When the desalinization is required, the necessary water amount for the treatment should be comprised in the estimate.

iii) Irrigation scheme

Irrigation networks shall be designed to cover the whole project area, and the preliminary design should be made on the major structures to be provided.

iv) Land consolidation scheme

The land consolidation scheme shall be made to be suited for elimination of bottlenecks of irrigation and drainage, promotion of farm mechanization and improvement of farming techniques, and the construction cost estimate of terminal facilities will be made on the basis of the scheme established as such.

v) Drainage scheme

The drainage scheme shall be established so suitable for the topography and the cropping pattern employed in the project. For low-

lying marsh lands, the provision of dikes and drainage pumps as well as natural drainage shall be studied. The underground drainage should be carefully studied for the places where the desalinization is required and the groundwater table is considerably high.

vi) Design of drainage canals and related facilities
The drainage canals and related facilities shall be designed preliminarily according to the Drainage Scheme with fundamental dimensions of the major structures determined.

vii) Proposed land use
According to the results of field survey on the present land use, the proposed land use shall be established as the basis of construction schedule, farm management, and economic evaluation.

viii) Desalinization scheme
For the places requiring to implement the desalinization based on the field survey, the disalinization scheme shall be established in consideration of soil conservation, irrigation and drainage schemes, cropping pattern, etc.

ix) Farm management scheme
The farm management scheme shall be established in view of cropwise cultivation system and method, input materials, processing and storage, etc. Also, the estimate shall be made on necessary funds and quantity of materials necessitate for execution of the scheme.

x) Scheme for farmers' organization
The proposed farmers' organizations shall be established taking into account the farm management, water management, crediting to farmers, cooperative societies, distribution system and marketing, etc.

xi) Scheme of extension service and farmers' education and training
The scheme for the subjected matters shall aim to provide the effective and practical organization of extension services, research institutes, pilot farms including the facilities of farmers' training.

xii) Improvement scheme for farm mechanization

The farm mechanization scheme shall be established so as to achieve the working efficiency and to enable to apply new farming techniques by improvement of farming equipment.

xiii) Economic evaluation of the project

The economic evaluation of the project shall be made on the basis of comprehensive study of the above-mentioned schemes.

xiv) Proposal to project implementation

The proposal shall be made to the project implementation according to the implementation scheme to be established.

d) Interim Report

The Interim Reports shall be prepared to submit authorities concerned when the field survey is completed, and the reports shall be made on the survey results, when respective surveyings are over.

e) Home office works

The field services of the project include data collection, surveyings, plan formulation, and the first and the second interim reporting, and the further services will be conducted in the Home Office in the following items.

i) Preparation of the Draft Final Report

The Draft Final Report shall be prepared after finishing the second interim report based on the respective schemes established, and submitted to the Government to enable to issue the comments on the reports within a month after the date of submission.

ii) Reviewing the Draft Final Report in Japan

The review meeting shall be held in Japan on the Draft Final Report in order to make revisions, if necessary.

iii) Revision of the Draft Final Report

The definitive revision of the Draft Final Report shall be made according to the comments to be made by the Iraqui Government.

iv) Submission of the Final Report

The Final Report with definitive revision completed shall be

submitted to the Iraqi Government within a month after revision of the Report.

The Number of reports to be submitted to the Iraqi Government shall be 20 (Twenty) copies for the Interim Reports and the Draft Final Reports respectively, and 50 (Fifty) copies for the Final Report.

f) Requests to the Irqi Government

It is highly appreciated that the Iraqi Government will take care of the following matters so that the field works can be proceeded smoothly in every respect.

i) The entry visas for the Mission members shall be issued without any undue delay. Taxes, duties, levies and any other assessment to be imposed while the members staying the country shall be exempted (This request shall be only applied to the services rendered on the commercial basis of consulting services in the field).

ii) For the equipment and materials to be brought into Iraq by the Mission, the duties for customs clearance or any other local impositions shall be exempted.

iii) The necessary number of counterparts personnel to every expert shall be provided during the service period.

iv) The following vehicles, office facilities shall be provided both in Baghdad and Amara city during the service period.

- o Four (4) vehicles for official use (Providing drivers, fuel oil, and other necessary cost for operation and maintenance)
- o Office spaces and lodging accomodation with furniture for about 14 (Fourteen) Japanese Experts

v) Necessary number of laborers for field survey

vi) Permissions shall be issued for the Mission to enter the project area and surveyings, measurements, and trial drilling/boring on the job site for the soil surveys.

vii) The data, reports, maps and any other reference materials to be required for the survey shall be provided or lent to the Mission.

viii) The equipment and instrument necessary for survey and experiments in the field shall be provided, and also the manpower to be required for this execution.

ix) Office cleark (s) and typist (s) shall be provided for routine office works and preparation of Reports.

x) Other cooperations by the Government in any respect will be expected.

g) The Members of the Survey Mission

The survey Mission for execution of the project shall be composed of the following members.

	Specilized Field	Services in Charge	Assignment Period (M/M)		
			Field	Home	Total
1.	Planning Engineer	Comprehensive Project Planning (Team Leader)	3	3	6
2.	Irrigation Engineer	Planning for Irrigation & Land Consolidation	3	3	6
3.	Hydrologist	Planning for Water Sources & Data collection and analysis of Hydrology & Meteorology	3	1	4
4.	Canal Engineer	Planning, Designing & Estimate for Canal Construction Works	3	2	5
5.	Drainage Engineer	Planning, Designing & Estimate for Drainage system and Related Structures	3	2	5
6.	Soil Expert	Soil Survey & Planning for Desalinization	3	2	5
7.	Land Use Expert	Planning for Proposed Land Use	3	2	5
8.	Agronomist & Farm Management Expert	Study of Farming Techniques & Input Materials	3	2	5

	Specilized Field	Services in Charge	Assignment Period (M/M) Field	Home	Total
9.	Farming Machineries Expert	Planning for Farm Mechanization	3	2	5
10.	Farmers' Organization & Extension Expert	Planning for Farmers Organization, Extension Services & Farmers Education	3	2	5
11.	Agro-economist	Economic Evaluation of the Project	3	3	6
12.	Construction Planning & Equipment Engineer	Planning and Preparation of Proposed to Construction Works & Equipment	2	2	4
13.	Hydrogeologist	Survey for Groundwater and Geology	3	1	4
	Total		38	27	65

h) The Assignment Period of the Survey Mission

The assignment of the Mission will last about 8 (eight) months, and the expertwise and the itemwise assignment schedules are referred to the following table.

i) Cost Estimate

Total amount is estimated at US$583,944 for feasibility study, containing the following detailed items.

1.	Engineering Fee	US$436,289
		(unit: US$)
i)	Direct Salary	US$145,323
ii)	Overhead Charge	" 159,855
iii)	Engineering Fee	" 122,071
vi)	Expenses for Researches & Experiments	" 9,040

2.	Direct Expenses	US$147,655
i)	Travel Expenses	US$100,635
ii)	Field Survey Expenses	" 24,288
iii)	Expenses for Equipment and Materials to be brought into the Fields	" 7,172
iv)	Expenses for Preparation of Report	" 15,560
	Total	US$583,944

CHAPTER VIII. PILOT FARM

8-1 Purpose and Function of Pilot Farm

The pilot farm functions as a base on which the conventional way of farming shall be modernized and improved to extend new technique to the farmers. The improvement of farming techniques should not be made at a jump to high level the farmers cannot follow, but step-by-step approach should be taken so that every farmer can learn and apply by himself.

The major services the pilot farm should make will be as follows:

a) to select superior paddy varieties (tasty and high yielding),
b) to study on fertilization (preparation of standard for dosing fertilizers best suited to the local conditions),
c) to study on sowing and transplanting (the most rational sowing available and the best suited planting density),
d) to study on farm mechanization (preparation of standard on mechanized farming by proper type and size of the machines),
e) to study on increasing soil fertility (application of fertilisers and manure),
f) to study on rotational cropping system (preparation of cropping calendar including other crops than paddy for increasing farmers income),
g) to train farmers (upbringing mainstay farmers and/or model farmers)
h) to train the extension staff or leader farmers in order to give direct guidance to farmers (holding a training session for leaders of farmers during paddy cropping period).

8-2 Scale of Pilot Farm and Facilities

The optimum scale of the pilot farm is approximately 120 Donum, 40 Donum of which shall be under direct management of the Governmental organization. The rest 80 Donum, privately-owned lands, shall be involved in the pilot scheme and the selected farmers shall grow the crops according to the cropping program prepared by staff in charge of pilot farm; all the farmers involved in the pilot scheme shall work under supervision of the

authorities concerned.

In such case, the products harvested in the farmers' own land should should belong to the respective farmers so as to encourage them and cooperate with the pilot farm officials, and it is recommended that the necessary costs for for agri-input and machine operation shall be defrayed from the budget of the pilot scheme and the farmers should only offer their labor forces.

8-3 Necessary Facilities and Their Scale

a) Farm plots

i) Demonstration farm of farming techniques and its effects about 12 Donum

The demonstration farm aims to show farmers the good effects produced by the best available techniques developed based on the results which have been obtained in trial farm or any other experimental facilities.

ii) Trial farm about 12 Donum

The trial farm is provided for conducting various trials and experiments on such items as applicability of crops to local conditions, water control, fertilization, mechanized farming, pest control, establishment of cropping pattern, and other applied farmings.

iii) Base farm for extension about 80 Donum

This is the pioneer farm for extension that farmers themselves try to do practical farming with improved techniques transferred from the pilot farm.

iv) Training farm about 8 Donum

The selected farmer trainees shall take exercise in this training farm.

v) Seed multiplication farm about 8 Donum

This farm is provided for multiplication of seeds for the extension purpose.

b) Buildings

An area of about two hectares will be required as building lots of various facilities. The general idea on buildings included in the scheme is outlined as follows:

i) Management Center

- o Managerial office — about 480 m^2

  An office room (about 15 officers servicing), a conference room, operation room for wireless telephone communication, etc.

- o Experts' room — about 360 m^2

  A room for experts and their counterpart personnel, a conference room, a data room

- o Laboratory — about 300 m^2

  A laboratory and a lecture room

- o Storehouse for farming materials — about 300 m^2

  A warehouse for agri-input materials storage

- o Repairshop — about 330 m^2

  A factory for maintenance and repair of farming machines and equipment

- o Machine shade — about 500 m^2

  A garage for farming machines and vehicles

- o Other Facilities — about 500 m^2

  Including milling plant, drying yard, gas-station, etc.

ii) Training center

- o Lecture room — about 660 m^2

  Including lecture room, rest room, a projection room, meeting room, recording room, library, and management room for the center.

- o Dining room — about 330 m^2
- o Trainees' Lodging Accommodation — about 500 m^2

iii) Residential facilities

- o Residences for experts — about 500 m^2

  5 houses (100 m^2 for each)

- o Guest house — about 300 m^2

8-4 Demonstration Farm

The most effective way of extending improved techniques proved in the pilot farm will be to practice the techniques in several demonstration farms in the project area. Such demonstration farm will be the size of about one Donum and managed individually by the farmer who owns the field or collectively by the group of the neighboring farmers. And the extension staff should give intensive gurdance to such farmers. The demonstration should include fertilizer application and varietal comparison so that the farmers can learn the techniques by seeing actual results.

Fig. - 11 Relationship Between Pilot Farm and Demonstration Farm