IRAN

REPORT ON PRELIMINARY SURVEY FOR AGRICULTURAL DEVELOPMENT OF SISTAN PLAN

MARCH 1973

OVERSEAS TECHNICAL COOPERATION AGENCY

ADDRESS

The present Preliminary Survey Mission for Agricultural Development of Sistan Plain was dispatched by the Government of Japan in response to the request of the Imperial Government of Iran which is desirous of inviting the former's technical assistance towards establishing a Pilot Farm - a pioneer of Sistan development project which is now under construction.

The term reference of the Mission was to study: (i) current situation of Iranian agriculture; (ii) water utilization project and related agricultural development project, inter alia, Pilot Farm Scheme, of Sistan Plain, and (iii) feasibility of Japanese Government's technical assistance in implementing the said Scheme. The first task for the Mission to take upon itself, that is, the exploration of the current situation of Iranian agriculture was, of course, extremely defficult or hardly practicable within the given time-limit; the best it could achieve was to make field-observation of some agricultural centres in Iran, such as Khuzistan in the south where it studied agriculture in general and agri-business in development; Shiraz, also in the south, where it observed animal husbandry, and Rasht along the Caspian Seas in the north where it checked paddy cultivation. The Mission's visit at Khuzistan which is situated in arid and high-temperatured south proved to be most rewarding as its study on crop production potentials there is believed to be of close relevance with that in Sistan which is under the similar climatic condition.

Techno-economic features of Sistan Plain were studied through expertise knowledge and experience of the members of the Mission but, admittedly, the first-hand information obtainable then and there was limited to that ruling under wintery conditions; Mission is, therfore, of the opinion that the complementary survey would need to be made to grasp the environmental conditions and farming practices in Sistan during the harsh summer season known for its extreme aridity and high-temperature.

Incidentally, Mission was very much facilitated in its study in Sistan by the pertinent advices and ample data provided by the Sanyu Consultants whose resourcefulness is due to many years' standing on this project and their current construction supervisory assignment on the engineering part of Sistan Water Utilization Project. Mission regrets, however, of its inability to place its hand on few other materials excepting those provided by the Sanyu Consultants and, also, to devote enough time for personal conversation with the local farmers. Particulars of the land, tenurial system, farm management, etc. in the project-area are indeed essential items of information on which to erect any rural development program, and have to be obtained by all means on another occasion. Being utterly foreign to the religion as well as ways and manners of Iranian villagers, the Japanese experts would not be expected to collect reliable information on these and other aspects without positive co-operation and assistance of the Iranian authorities concerned.

In conclusion, the present Mission wishes to reiterate its sincere thanks to the officers concerned of the Ministry of Foreign Affairs and Ministry of Agriculture & Forestry of the Japanese Government as well as the Overseas Technical Co-operation Agency for their guidance and co-operation in its fulfilment of duty; thanks are likewise due to the authorities concerned of the Imperial Government of Iran, the Japanese Embassy and the Sanyu Consultants. The undersigned knows that, without the co-operation of all those mentioned above, the Mission would not have been able to achieve whatever it could so far. Mission submits this report as of preliminary nature with the hope that it might provide some basic information helpful for arriving at final findings through the complementary survey which should follow preferably during summer season in Iran. Remembering that almost half as much petroleum as Japan consumes is coming from Iran, Japan might as well reciprocate it in terms of effective technical assistance towards Iran.

With ardent prayers for successful development of Iranian agriculture!

Tamotsu Seino

Tamotsu Seino

Head

Preliminary Survey Mission
for Agricultural
Development in Sistan, Iran.

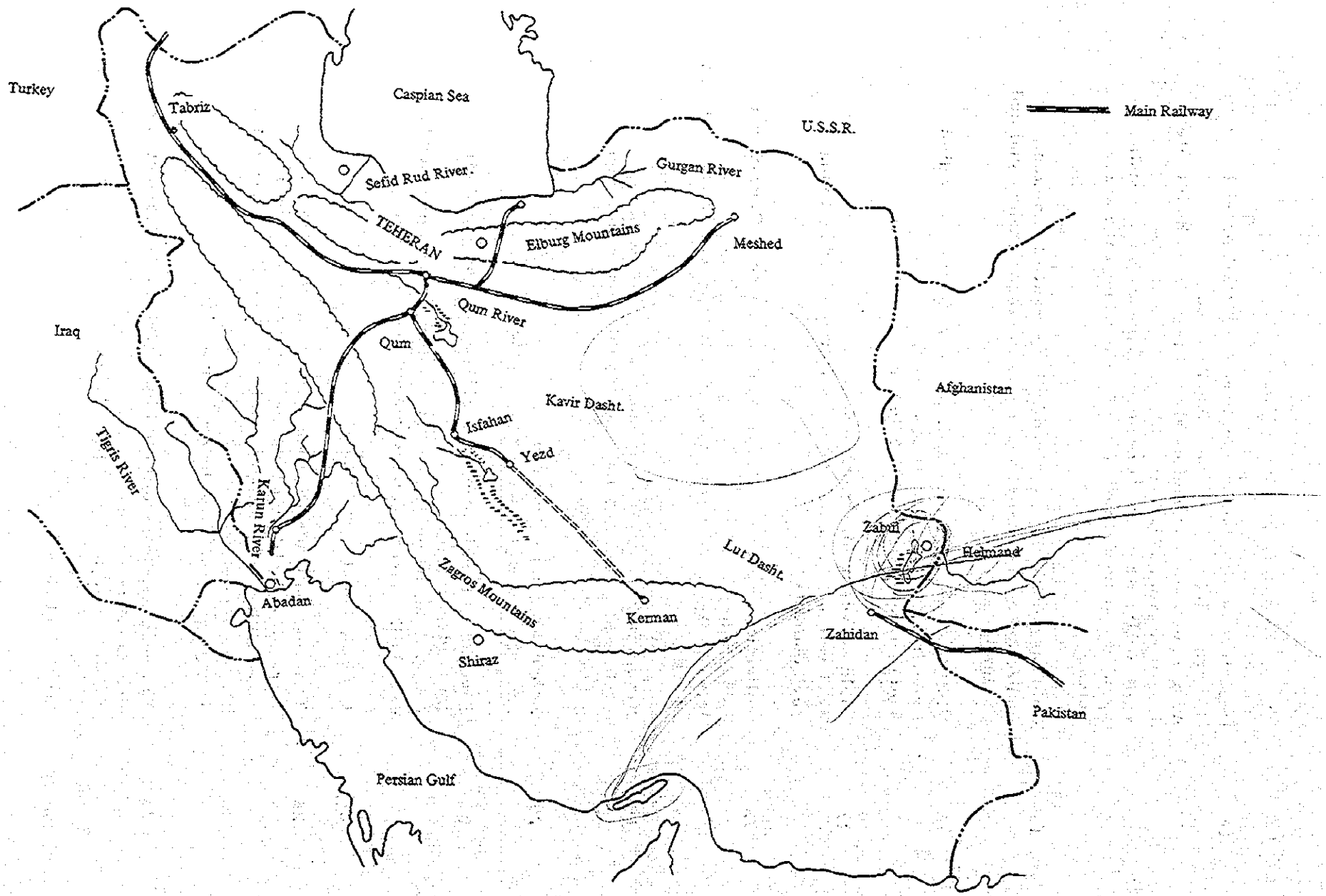
LIST OF MISSION MEMBERS

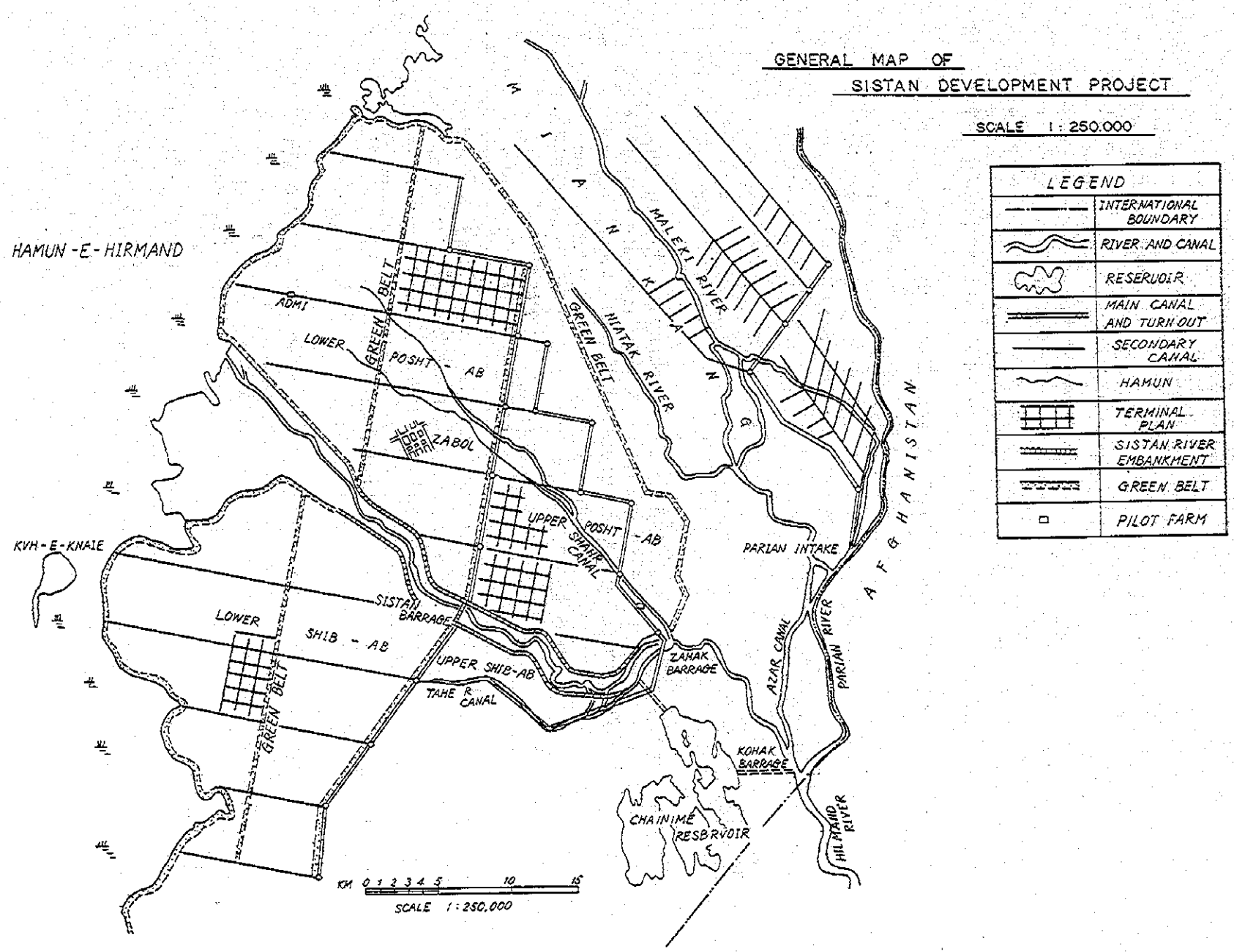
Name	Assignment	Affiliation
Tamotsu SEINO	Leader and Irrigation	Dr. of Agr. Pre-Vice Director General Aichi Irrigation Public Corperation
Shiro TERAZAWA	Soil and Fertilizer	Institute for Agricultural Technique, Ministry of Agriculture and Forestry (M. A. F.)
Hiroshi IKEDA	Crop Cultivation	Agricultural Experiment Center, M. A. F.
Yukio TAKEI	Livestock Farming	Livestock Bureau M. A. F.
Etsuro KAGAI	Agricultural Economy	Agricultural Economic Bureau M. A. F.
Katsuhiko BIYAJIMA	Planning and Co-ordination	Agricultural Cooperation Division, Overseas Technical Cooperation Agency
Marehito IKEDA		Economic Cooperation Bureau, Ministry of Foreign Affairs.

ITINERARY OF SURVEY MISSION

Date	Description
Dec. 5	Departure from Haneda International Airport.
6	Arrival at Teheran; Courtesy call made on the Ministry of Agriculture; Consultation with Mr. Goleli, Director of International Relations Department, for arrangement of the survey schedule; Courtesy call made on the Japanese Embassy.
7	Courtesy call made on the Ministry of Water and Power where consultation was made for the survey; Information about Sistan district received from the Ministry of Land Reform and Rural Cooperatives and from Kage-Sanyu Consultant.
8	Final arrangement with the Japanese Embassy and Iranian Government for determination of survey items and schedule.
9	Visit to Khuzistan province for survey of agribusiness; Teheran - Abodan - Ahwaz - Safiabad.
10	Inspection of Dez dam and agribusiness enterprises in the downstream area; Visit to the Khuzistan Development Agency where views were exchanged and information provided on the province's development scheme.
11	Safiabad - Ahwaz - Teheran; Visit to the Ministry of Water and Power (mission leader and Miyajima) where opinions and views were exchanged with the vice-minister on the problem of water resources development.
12	The party led by the mission leader made a courtesy call on H.E. Mr. Mansur Ruhani, Minister for Agriculture, and discussed with Mr. Milheidari, vice-minister, for an hour about the existing Rasht Pilot Farm established in the coatal area of Caspian Sea; The party comprising Takei and other members took a flight to Shiraz to visit the Livestock Research Institute and Soil Research Institute, and made a courtesy call on the Provincial Government of Shiraz; The party led by the mission leader inspected Rasht Rice Research Centre and Pilot Farm.
13	The two parties returned to Teheran; All mission members and Secretary Ikeda of Foreign Office attended the dinner party held by Counsellor Ikeda of the Japanese Embassy.

14	Departure of all mission members for Sistan district (Teheran - (air) - Zahedan - (car) - Zabol); Arrival in Sistan district by air and jeep in six hours after departure from Teheran; Visit to Mr, Kamalie, Director of Baluchistan and Sistan Agricultural Department for discussion about the survey items.
15	General information provided by Kage-Sanyu Consultant; Inspection of Sistan district (Zahak barrage, Shahr canal and Chainime dam).
16	Visit to Zabol Agricultural Experiment Station and Adimi Experiment Farm, and field survey; Field survey of Hamun-e-Hilmand.
17	Field survey in Miankangi area; Reviewal of local data and investigation of urban living environments.
18	Collection of data on pilot farm at the office of Gage-Sanyu Consultant; Intra-party meeting for arrangement and compilation of survey results.
19	Return to Zahedan from Babol; Visit to Mr. Kamelie to whom the mission leader gave a general survey report.
20	Zahedan - (air) - Teheran; Arrangement of the field survey data.
21	Discussion held between all mission members and Mr. Milheidari; General report on Sistan district development privided to Mr. Milheidari and opinions exchanged with him.
22	Compilation of survey data.
23	The mission leader and some mission members visited Karaj Razi Institute (Livestock Research Institute) and Serological Research Institute of Venomous Serpents; Data collection (Kagai and Biyajima); Dinner party held by the mission leader.
24	Farewell greetings offered to the Ministry of Agriculture and Japanese Embassy; Departure from Teheral for Tokyo.
25	Arrival at Haneda.


Turkey
Tabriz
Caspian Sea
U.S.S.R.
Main Railway
Sefid Rud River
Gurgan River
TEHERAN
Elburg Mountains
Meshed
Qum River
Iraq
Qum
Afghanistan
Kavir Dasht
Isfahan
Yezd
Tigris River
Karun River
Zabul
Helmand
Lut Dasht
Zagros Mountains
Abadan
Kerman
Zahidan
Shiraz
Pakistan
Persian Gulf


GENERAL MAP OF
SISTAN DEVELOPMENT PROJECT
SCALE 1 : 250.000
LEGEND
INTERNATIONAL BOUNDARY
RIVER AND CANAL
RESERVOIR
MAIN CANAL AND TURN OUT
SECONDARY CANAL
HAMUN
TERMINAL PLAN
SISTAN RIVER EMBANKMENT
GREEN BELT
PILOT FARM
HAMUN -E- HIRMAND
KVH - E - KNAIE
IRAN
AFGHANISTAN
MALEKI RIVER
KAJAKI
HIRMAND RIVER
GREEN BELT
ADMI
LOWER POSHT - AB
ZABOL
UPPER SISTAN CANAL
POSHT - AB
SISTAN BARRAGE
LOWER SHIB - AB
UPPER SHIB-AB
TAHE R CANAL
GREEN BELT
ZAHAK BARRAGE
PARIAN INTAKE
AZAR CANAL
PARIAN RIVER
KOHAK BARRAGE
CHAINIMÉ RESERVOIR
HILMAND RIVER
KM 0 1 2 3 4 5 10 15
SCALE 1 : 250,000

CONTENTS

I. INTRODUCTION

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1-1 Background of the Survey

The Sistan Project is a scheme formulated in accordance with the agreement concluded between the Iranian government and Kage-Sanyu Consultant, and its feasbility report has already been prepared. The project was partly put into execution in 1971 under the Fourth Five Year Development Plan, and is expected to be completed under the Fifth Five Year Development Plan.

Pursuing after smooth agricultural development in Sistan district under this project, the Iranian government planned to establish a pilot farm which is to be charged with the task of conducting the necessary researches and experiments as well as extension activities.

The present survey was conducted in compliance with the request of the Iranian government for Japan's technical assistance in the planned agricultural development including establishment of the pilot farm.

1-2 Purpose of the Survey

The survey was carried out for the following purposes.

1) Clarification of the existing state of agriculture in Sistan district.

2) Reviewal of the water resources development plan and agricultural development plan (inclusive of the establishment and operation of a pilot farm) which are incorporated in the project.

3) Reviewal of the possibility of offering Japan's technical assistance in the project.

In conducting the survey, efforts were made to bring light to the present situation in Sistan district from the existing state of agricultural development in other parts of the country in order to study how Japan could offer her technical assistance in the district's agricultural development.

Being a short-period survey conducted for the first time for the project cooperation, the present survey is to be regarded as a pre-preliminary survey and should therefore be followed by more detailed surveys in the coming years.

1-3 Agricultural Development under Sistan Project

Through execution of its Fifth Five Year Plan, the Iranian government plans to raise the annual growth rate of agricultural production to 5.8 % to cut down import of agricultural products and hopes to meet the greater part of the nation's protein requirement by domestic production. The Iranian government estimates, however, that the country will have to import a

substantial amount of farm produce even after completion of the Five Year Plan.

Sistan district embraces an extensive plain and is favoured with strong sunshine. If development of water resources pursues a smooth course of progress, therefore, the district will play a vital role in the augmented agricultural production envisaged by the Five Year Plan.

To turn this district into a fertile agricultural area, the government is planning to introduce irrigation farming in 101,000 ha in a total project area of 155,000 ha. As tabulated below, the government's plan is to cultivate winter crops (wheat, barley and cumin), summer crops (beans, melons and sugar beat), oil crops, and forage crops (alfalfa and perusian clover) in the said 101,000 ha irrigated area. The estimated total annual value of production in this area is Rls 2,500 million.

District	Project Area	Irrigation Area
Miankangi	42,000 ha	23,000 ha
Posht-AB	70,500	47,280
Shib-AB	43,000	30,720
Total	155,500	101,000

The mission visited the Agricultural Experiment Station of Khuzestan Water Development at Safia Abad. The experimental data obtained at this station serve to study the possibility of cultivating the various crops mentioned above under the project. The western part of Sistan district is not only in the approximately same latitude as Safia Abad but also shows little difference in both temperature and humidity, though rainfall in winter is somewhat larger at Safia Abad. The data indicate that most of the above-mentioned crops can be raised and will show a high yield rate in the western part of the district provided that a rational irrigation and drainage system is established and adequate measures are taken for reducing soil salinity. It is to be added that mechanized farming of various crops conducted in the Agri-business area of Khuzestan district can be introduced into Sistan district because of its favourable climatic condition. It is no exaggeration, therefore, to say that the way is opened up for introducing modern farming techniques into the district. The mission is of the opinion that the key to the district's agricultural development lies in the creation of farmers' associations, enhancement of smooth organized farming work and improvement of the distribution mechanism.

1-4 Outline of Sistan District

Sistan district is an alluvial plain formed by the Hilmand river rising in Afghanistan and lying in the southeastern part of Iran between Lat. 30° 31' and 30°31' N and between Long. 61°30' and 62° E. Its elevation and total area are 460 - 500 m and 250 thousand ha respectively.

The district presents a continental dry climate characteristic to Near and Middle East. Atmospheric temperature is high in summer (35° - 40°) and relatively low in winter (0° - 10°). Rainfall is practically negligible (approx. 45 mm) and can be observed only in winter, while annual evaporation is as large as 5,000 mm. The climate in the district is characterized by the north or north-westerly wind blowing in summer at an average velocity of 12 to 16 m. The wind blows through dry farmland area deve d of vegetation so that it causes wind erosion and develops dunes.

The district is inhabited by about 170 thousand people. About 20 thousand of this population live in Zabol city, the political and economic centre of the district, and the greater part of the remaining 150 thousand people are engaged in agriculture and livestock farming. Farmers draw irrigation water level, however, declines extremely in summer. The river's water is therefore used chiefly in winter for irrigation farming of wheat and barley. In summer, only a fraction of the district (about 15 % of the total cultivated area) is irrigated with its water for production of beans, melons, cotton, alfalfa, fruits and vegetables.

This poor farmland utilization, coupled by the irrigation of upland fields lacking suitable drainage facilities, is inviting increased soil salinity, so that the crop yield per unit area in the district is much smaller than in other parts of the country and farmers' living standard is extremely low. In the northwestern part of the district, the shortage of agricultural income is covered by livestock farming which is made possible by virtue of Humune-Hilmand. Farmers living near this lake raise livestock, mostly sheep, by feeding rush which grows around the lake in spring when it retains water.

1-5 Sistan District Water Resources Development Plan

Sistan plain had long been irrigated with water drawn from the Sistan and the Parian, the tributaries of the Hilmand river which flows along the Iran-Afghanistan border line. In 1953, however, Afghanistan constructed a dam at a upstream point of the Hilmand under its development plan, and to cope with this dam construction, the Iranian government constructed two barrages on the Sistan, one at Kohak and the other at Zahak. Construction of these barrages, particularly that of Kohak barrage, resulted in the decrease of inflow into the Sistan from the Hilmand, causing unstable supply of irrigation water. In an effort to bring solution for this problem and ensure efficient utilization of the Sistan, the Iranian government established the Sistan District Development Project. Under the project, it is envisaged that water will be drawn from the Parian (partly to be pumped up) in Miankangi district in the north; whereas in Sistan district, water is planned to be drawn from the Sistan through the existing Zahak barrage for supply to Upper Poght-AB and Shib-AB. It is also envisaged by the project that for irrigation of Lower Poght-AB and Shib-AB, water will be drawn from Sistan barrage to be newly constructed on the river's downstream section, with the shortage to be covered by Chainime reservoir which will be constructed in Chainime depression found on the river's right side bank. It is planned that spring flood water of the Sistan will be stored in the reservoir and released in the dry season into the section upstream of Sistan barrage. To bring this scheme to a reality, irrigation and drainage canals having a total length of 1,348 km are planned to be constructed in the two districts.

The total construction cost is approximately Rls 6,000 million (estimated in February 1971). The construction work was approved under the Fourth Five Year Plan and is expected to be completed under the Fifth Five Year Plan which is to be started in 1973.

1-6 Problems Involved in the Project

Despite of its extremely short period of stay in Iran, the mission was required to cover an extensive scope of survey activities. For preparation of this report, therefore, the mission had no choice but to obtain the necessary information through interviews with the relevant Iranian authorities and individuals and from the data provided by them. Iranian authorities and individuals and individuals and from the data provided by them. Hence, the mission is aware that the report is open to criticism on the score of its being rather superficial.

For this reason, a closer approach should be made to the project during the supplementary survey to be conducted in 1973 summer season, with direct interviews with farmers and surveys by means of questionnaires made in order to get a clear picture of agriculture in the district.

The mission was unable to collect basic data on the existing status of rural communities, economic conditions and so forth which are all indispensable for planning the establishment of modern agricultural communities in the district. These data should be collected during the forthcoming survey so as to facilitate researches and experiments on farm management and land use to be conducted at the pilot farm.

In the following items, brief description will be given on some of the problems entailed in the project.

(1) Construction of a dam by the Afghan government on the upper of the Hilmand, an international river, has caused change in its run-off and invited the downward trend of the annual discharge of the Sistan. Hence, it cannot be guaranteed that the Sistan's present discharge will be maintained in future. The 60 % irrigation efficiency envisaged by the project is therefore reasonable and on the safety side. Considering the fact that supply of water bears closely in many senses on the district's development, the importance of satisfactory water management cannot be exaggerated. The planned pilot farm will be required to undertake studies and training in the water management techniques.

(2) Crops are cultivated chiefly by basin irrigation at present. Considering the possible introduction of mechanized farming in future, it appears essential that furrow irrigation should be studied in relation to the farming techniques. This irrigation problem need to be put to an integrated study involving farming and farm management at the pilot farm.

(3) Soil surveys so far conducted are far from satisfactory. Detailed physical and chemical surveys should be made in the coming years to obtain the data for crop cultivation, with adequate measures also taken to prevent salt injury in areas showing a high pH value.

(4) The sedimentation of soil particles in the Sistan and the Parian should be studied to clarify its correlation with the sand storm caused by the north or northwesterly wind blowing in summer in order to prevent sediment deposition in the canals.

(5) Surveys so far made on the quantity and quality of feed resources currently made use of in Sistan plain are not satisfactory. Full utilization of the precious feed resources is of controlling importance because the livestock raising farmers in the district have a very small operational holding. It is to be added that in planning the rotation pattern, the relationship between the feed resources and forage crops should be made clear so as to be able to look into the possibility of breeding livestock along scientific lines.

(6) The actual condition of land use and farm management should be brought to light for establishment of management patterns compatible with the district's natural conditions and for creation of modern agricultural communities. For this purpose, the pilot farm should have a management and land use improvement section which is to maintain close cooperation with other sections of the farm in order to plan the most suitable farm management patterns and to prepare the data required for economic stabilization of farming villages.

1-7 Recommendations

Considered from any angle, it leaves little doubt that extreme difficulties will be involved in econouraging the farmers in the district to organize themselves into an agricultural cooperative association and apply advanced farming techniques so that they will shift from the prevailing traditional farming practices to modern entrepreneurial farm management. However, this is a problem to be tackled by the Iranian government which has the keen desire to promote the development of Sistan plain through the project implementation.

In an attempt to curb import of agricultural products, the government attaches most weight to augmented agricultural production in its Fifth Five Year Plan which starts from 1973. During the coming five years, the government is hoping to materialize two plans, i.e., the creation of 300 thousand ha farmland area through agri-business operation and the improvement of the existing 400 - 500 farmland area (source: Minutes of the Japan-Iran Investment Meeting). The latter plan is commendable since it is the basic and most adequate measure for structural improvement of Iranian rural communities. The mission wishes to state that it felt great respect for this forward-looking plan of the Iranian government. In Japan, too, farmland improvement was pushed forward after World War II with the budgetary appropriation for increased food production and then for agricultural infrastructural improvement. The appropriation for these two items, which carried a heavy weight in the government's budget for public works, is known to have contributed largely to the postwar development of Japanese agriculture.

It is to be poisted out, however, that structural improvement of agricultural society and stabilization of agricultural production cannot be attained by the improvement of agricultural infrastures alone. Creation of modern and advanced farming villages demands that the infrastructual improvement be accompanied and backed up by adequate price policy and land policy.

In Sistrict, agricultural production is limited due to deficient availability of irrigation water and the annual growth rate of agricultural population is no larger than 1 %. The mission was informed that many farmers leave the district and flow into Gorgan and cities on the Caspian coast. In addition, the operational holding per farm household estimated from the total present farmland area is no larger than 2 to 3 ha, and this is expected to increase to only about 5 ha after completion of the project. Further, 60 % of farmers own an operation holding of less than 8 ha, and only 12 % of them own a farmland area larger than 40 ha. In other words, the majority of farmers are the small holders subsisting on winter crop cultivation by the traditional farming practices and on livestock farming, so that their financial footing is just too poor to accumulate own fund. Therefore, it cannot be expected that these farmers will readily make capital input for increased production upon completion of the dams, canals, etc. which the government is planning to construct as prerequisite to augmented agricultural production. However, the government must tackle this problem in a positive way, noting that unless improved farming techniques are established and extended by the planned pilot farm, no solution can be brought for this problem, nor can it be expected to raise the agricultural productivity in the district. The mission wishes to add that progressive agricultural administration covering land, farm managment and other factors bears closely on the sound development of the district's agriculture.

II. SOCIO-ECONOMIC CONDITION IN SISTAN DISTRICT

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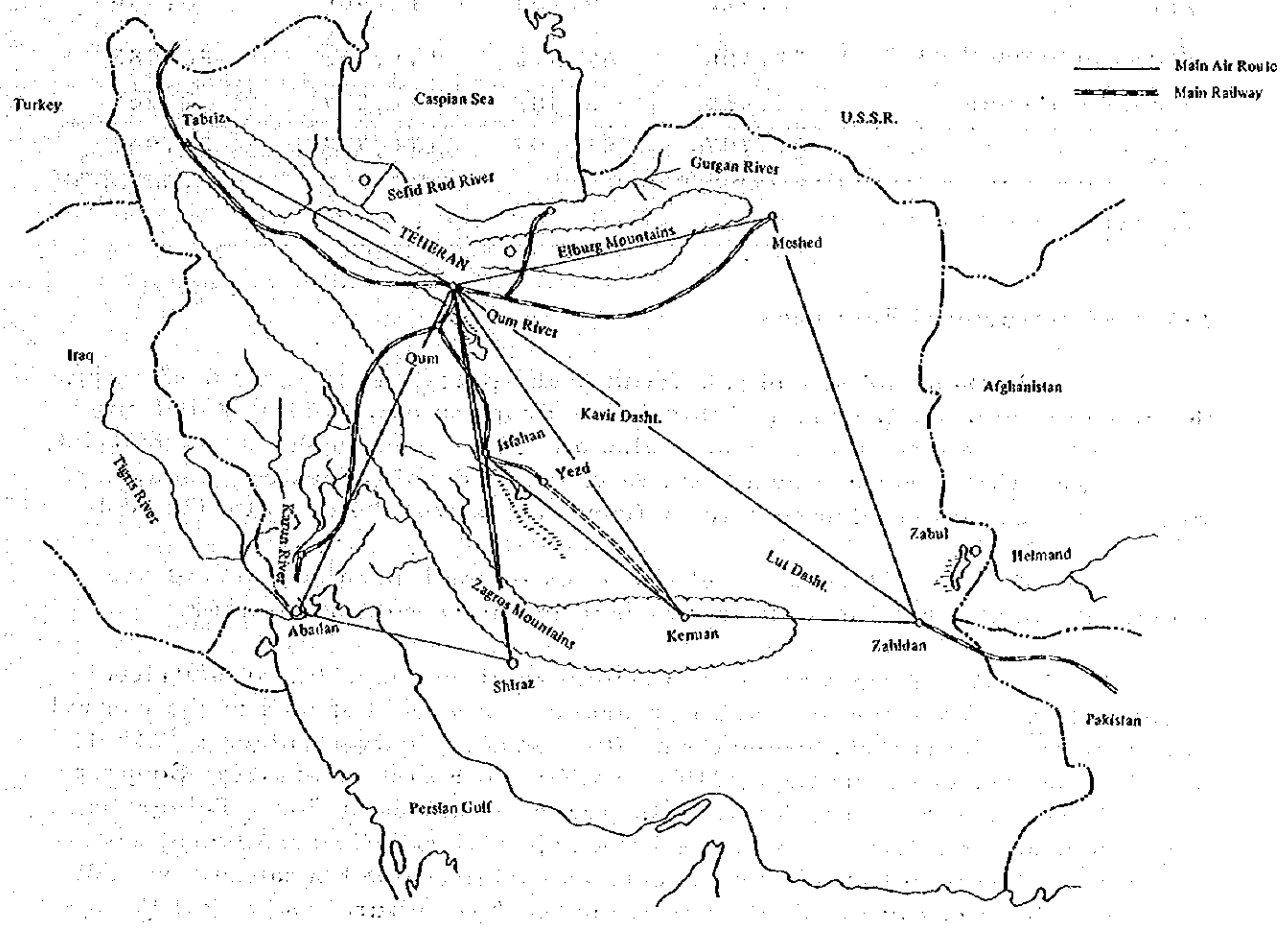
2-1 Transportation Facilities

The network of transportation facilities linking Zabol city, the centre of Sistan district, with Teheran and local cities is still in the initial stage of development. Zahedan city and Mashad city, located close to Zabol city, are connected with Teheran by regular flight services, but commodity transportation between Teheran and Zahedan resorts to trucks since no railway line is constructed between these cities.

Zabor is located at a point 210 km and 910 km far from Zahedan and Mashad respectively, and is severed from the two cities by the desert and mountains. Zahedan is closer to Zabol than Mashad, but since it is industrially backward and located in the easternmost part of the country, the district's population flows to Mashad or Gorgan city on the Caspian coast. For the planned economic development of the district, it will be imperative to construct new railway lines or well consolidated roads linking Zabol with Zahedan and Mashad.

Fig. Air Route and Railway Network



2-2 Population

According to the 1966 census, the district has a population of 171,794 (36,965 households), of which 11,257 persons (2,260 households) are nomadic people.

A little more than 10% of this population is found in Zabol city, the district's administrative and industrial centre.

The two censuses taken in 1956 and 1966 indicate that the annual population growth rate in the district during the ten year period was 1.2% which is far lower than the nation's average of 3.0%. This low growth rate is assigned to the fact that the district's natural condition is too harsh to retard the continued outflow of population (migration of all family members to other parts of the country or outflow of some family members seeking employment outside the district). Population migration within the district is quite active. This is evidenced by the sharp contrast created by the average annual growth rate in the district excluding Zabol city (less than 1.0%) and that in Zabol city (4.4%).

Table 1 - Population in Sistan District

	Population (person)			Number of Households
	Male	Female	Total	
Zabol City	9,572	9,234	18,806	3,720
Rural Communities	72,356	69,375	141,731	30,985
Nomadic People	5,869	5,388	11,257	2,260
Total	87,797	83,997	171,794	36,965

Source: 1966 census.

2-3 Infrastructural Facilities

Of the 28 thousand households found in the project area, only 6.6% enjoy the supply of electric power, and this figure drops to only 0.3% if Zabol city is excluded. The city supply ratio is also as low as 3.1% in the entire district, which means that rural communities are virtually devoid of water mains. Hence, farmers obtain drinking water from rivers (74.6%) or wells (23.3%).

Most of houses (82.4%) are either brick or mud made houses and are provided with a ventilation hole to dissipate intensive heat in summer.

Zabol is the administrative and commercial centre of Sistan district. In this city are found the provincial government and local offices of the central government. The central government offices having their agencies in Zabol are the Ministry of Agriculture, Ministry of Land Reform and Rural Cooperatives, Ministry of Finance, Ministry of Roads, Ministry of Post, Telegraph and Telephone, Ministry of Water and Power, Ministry of Development and Housing, Ministry of Natural Resources, and Ministry of Education. In addition, branch offices of the Bank of Iran and the Agricultural and Rural Development Bank of Iran are also found in this city.

Zabol city has a water supplying capacity of 2,000 m^3/day, so that drinking water is supplied to 94% of its area. As for electric power, six units of thermal power generators are installed to provide 1,290 KV of power, whereby 65% of the city area is supplied with electric power. In addition to these facilities, Zabol city has a hosptial (staffed by four doctors and nine nurses), post office, market, slaughter house, animal quarantine station, and agricultural experiment station.

The whole district are a excluding Zabol city is divided into 552 clusters. Public facilities and services available to these clusters are as listed below.

Primary school	109
Middle school	1
Education guidance group	46
Sanitation guidance group	14
Agricultural extension group	18
Home-life improvement group	8
Medical consulation station	3
Generator	2
Radio Set	138
Letter box	17

The figures shown above are based on the 1966 census. The mission was informed that educational facilities have been considerably improved since that time.

Zabol and Zahendan are connected by a Class 1 gravel paved road. For communication between Zabor and respective clusters in the district, gravel roads (Class 3 roads) are available. The mission learned that passage on these gravel roads often becomes impossible on account of flood water and sand storm. Traffic between Zabol and Zahedan resorts to the regular bus services. Although motorcycles, pickup buses and jeeps are on the increase in recent years, traditional transport means such as camels and mules are still found in the district.

2-4 Agriculture and Farm Household Economy

The district covers an area of 155.5 thousand ha, of which 65% or 101 thousand ha is cultivable.

Since the annual rainfall is as small as sbout 60 mm, crops are planted in winter when most of this rainfall is observed. In summer, crop cultivation is possible only in a limited area conditioned favourably for irrigation water supply. For details of the cropping condition in the district, refer to Section 4.

The total value of agricultural production in the district is Rls 413 million, consisting of Rls 278 million of the crop farming sector and Rls 135 million of the livestock farming sector (including forage crops). The total farmers' income is estimated to be 50% of this value or Rls 207 million, and this means that annual income per farm household is only about Rls 10,760 (equivalent to 43,000 yen).

This poor level of farm household economy is ascribable to the district's relentless natural condition, e.g., absolute shortage of rainfall, extremely high temperature and strong wind in summer and so forth. Improvement of the farmers' financial footing is impeded not by the stern natural condition alone. There are many other causes such as: farmers' low level of education and their lack of basic knowledges and techniques for improving farm management; and institutional backwardness as seen in the absence of an adequate research and experiment station, absence of an agricultural extension system, absence of agricultural cooperative associations, and complete absence of agricultural processing system, distribution system, agricultural credit system and so forth which are all indispensable for enlightening and raising the technical level of farmers.

2-5 Living Environments

Although the survey period was quite limited, the mission investigated the living environments in and around Zabol city.

It is an unescapable fact that conclusion of technical aid agreements for cooperation in agricultur l development projects has rarely been preceded by scrutinization of the living environments in the area where Japanese experts are to be stationed. The past tendency was such that the poor living enrironments which individual experts faced in their service area were regarded as their own problem. The mission holds the view that maximum efforts should be made to clarify the environments in the area to be developed so that suitable countermeasures may be taken before sending experts.

(1) Clothing, Food and Housing

(a) Clothes

In Zabol city, leather clothing is easy to obtain but cotton products (such as underwears and shirts) and chemical fibre clothes are not sufficiently available. Clothes are tailored raither simply by sewing machines, and these can be readily obtained at bazars. It is therefore advisable that chemical fibre products and clothes for daily use be brought from Japan.

(b) Food

Though the survey period was very short, the mission members were not satisfied with the oily food served such as boiled rice fried with butter, and mutton and other meat dishes. Fruits and vegetable can be obtained in Zabol city, but there can be found no food that meets the taste of Japanese such as dried laver, preserved food boiled down in soy.

Need will therefore arise for ensuring regular supply of such Japanese food.

(c) Housing

The most outstanding climatic feature of the district is the extreme

change of temperature. It is hoped that due consideration will be given to the temperature difference between summer and winter and the high daytime temperature during summer in providing accommodation for survey missions to be dispatched in future.

It is to be added that availability of satisfactory water supply and drainage facilities is one of the essential conditions.

(2) Medical Facilities

The mission visited the only hospital in Zabol and discovered that it is good enough for curing cold and binding the bowels. Since its inpatients included parturient women and appendicities patients, the hospital is considered capable of simple surgical operations. If any of the experts is attacked by a he heavy and complex disease, however, he will have to be carried to a hospital in Teheran. To check up the health of each expert and prevent him from falling ill, it will be necessary to send a medical examination group regularly (at least once a month). Further, arrangements should be made for emergency transportation of patients to a well equipped hospital in Teheran.

(3) Educational Facilities

Both primary and middle schools are found in Zabol and its vicinity, but since lessons are naturally given in Persian, they are not suited for education of experts' children. If the experts want to take their children with them, they will find no alternative but to place the children under the care of their friends in Teheran so that they may be educated at the Japanese school or English school in the capital.

(4) Entertainment and Recreation Facilities

In the district, the experts will be deprived of the solidarity with the society they used to have in Japan through mass media such as newspapers, radio and TV. If they are despatched alone, leaving their family in Japan for education of children, they will also be deprived of the comfort of home life. While this is likely to make them feel isolated and forlorn, the only entertainment facilities found in Zabol are the few cinema houses and one billiard saloon.

Hence, it is considered necessary to provide suitable recreation facilities for the experts, such as indoor game and sporting facilities (e.g., courts for playing tennis, badminton and volley ball).

What is more recommendable, however, is that the experts make position efforts in learning Persian and seeking social intercourses with Iranian people because such forward looking attitude will dispel the loneliness and also contribute to the performance of their duties.

The experts will be required to make regular trips to Teheran to maintain close contact with the Iranian government and Japanese embassy, and this will serve as a delightful deversion for them.

It is considered necessary to establish a system under which experts staioned in Iran on a long-term basis will be allowed to return to Japan temporarily for solution of the problems they face in their service area through consultation with the relevant Japanese research institutes.

III. IRRIGATION AND DRAINAGE

III. IRRIGATION AND DRAINAGE

3-1 Outline

(1) History of Irrigation in Iran

It can be said that irrigation in Iran started with the drilling of "Kanat." It is known that as many as 40 thousand kanats were drilled over the past 2,500 years and that 15 thousand of the 50 thousand farming villages in the country enjoy the benefit of kanat.

Kanats now in operation are estimated to range from 20 to 30 thousand in number. These kanats have a total groundwater discharge of 560 $m^3/5$ and cover an area of 1,500 thousand ha or 40 % of the country's total irrigated area (yield averages 40 /s in most cases, with the maximum yield being 400 /s and the minimum 1 - 2 /s).

Test drilling of kanat is conducted near a spring or at a place where the soil is moist. At first, a test bore hole having a diameter of about 60 cm is usually drilled to a depth of 15 to 50 m. When the bore hole reaches the groundwater vein, vertical wells are drilled along the vein. These vertical wells are connected by a tunnel having a height of 1.80 m and a width of 0.6 m for utilization of the detected groundwater. Distance between wells ranges mostly from 25 to 50 m, though it varies by the slops of groundwater table.

In Iran, many kanats are found in such cities as Mashad, Teheran, Qum, Yazd and Kerman which surround the Deserts of Kavir and Lut.

A great many dams and barrages are known to have been constructed in Iran over the past several centuries. The oldest of such dams and barrages are those which were constructed on the Karun river 1,700 years ago, and some of them are still in use for irrigation even today.

It was not a long time ago that the Iranian government launched into full-scale improvement of irrigation and drainage facilities. To be more precise, the government established, within its administrative framework, an independent Irrigation Agency responsible for pushing forward the government's policy for improved irrigation. Due to the lack of data, however, the agency directed its initial improvement efforts towards restoration of the irrigation projects which yielded excellent results in the past.

The agency started its activities with the construction of a number of facilities such as Kohak and Zahak barrages intended for supplying irrigation water to Sistan plain, once known as the country's granary zone; Shavour dam in Khuzestan district; and irrigation canal and Kooh-Rang tunnel in Moghan, The agency succeeded in irrigating an area of 40,000 ha by the construction of Kooh-Rang tunnel, but Shavour dam failed to yield the anticipated irrigation effect and the two barrages in Sistan district eventually invited salt injury due to the lack of adequate drainage facilities.

As greater importance came to be attached to agricultural development

under a number of economic development plans enforced by the government in later years, the irrigation area kept on increasing and covers 40% of the country's total arable land at present (See the table below).

Year	Cultivated Land	Irrigated Land	Ratio
1959	6,000,000 ha	2,530,000	42 %
1967	6,842,700	3,107,160	44
1972	7,650,000	3,550,000	46

(2) Economic Development Plans and Irrigation

As described already, positive and large-scale improvement of irrigation and drainage facilities was initiated with the commencement of the First Five Year Economic Development in 1949. However, the improvement efforts were suspended because the Five Year Plan was frustrated by the international conflict ensued from the nationalization of petroleum enterprises. It can be said that full-fledged improvement started with enforcement of the Second Economic Development Plan.

The following table shows the progress of agricultural development and irrigation improvement attained under Economic Development Plans.

	2nd	3rd	4th
Period	July 1955 - August 1962; 7 year plan.	September 1962 - March 1968; 5.5 year plan.	April 1963 - March 1973; 5 year plan.
Total Cost	Rls 75.4 billion	Rls 230 billion	Rls 480 billion
Input in Agriculture and Irrigation	Rls 16.5 billion	Rls 49 billion	Rls 65 billion
Ratio	21.9 %	21.3 %	13.5 %
Improvements Achieved	Construction of the following large dams were carried out. 1. The Sefid Rud dam for development of the Caspian coastal area. 2. Karaji dam in the northwest of Teheran. 3. Dez dam in Khuzestan district. During this period, however, no immediate irrigation benefit was derived from these dams.	Irrigation improvement was pushed forward for the following purposes: 1. Promotion of land reform. 2. Agricultural modernization. 3. Augmented agricultural production. 4. Production of commercial crops.	Irrigation improvement work was continued for the following purposes. 1. Development of farming villages to attain self-sufficiency in food. 2. Creation of sound living environments in farming villages.

In an effort to attain rapid modernization of Iranian agriculture, the government is planning to invest, under the Fifth Five Year Plan, an amount of Rls 3 to 4 billion in agricultural sector which is about four times the capital input made under the Fourth Five Year Plan. By this huge capital input, the government is hoping to accelerate the pace of agricultural mechanization, rise the yield per unit area, and meet the nation's protein food requirement by domestic production. To attain these purposes, the government intends to attach great weight to large-scale irrigation and drainage improvement works.

(3) Technical Improvements of Immediate Need

One of the problems involved in Iran's past agricultural development projects is the salt injury consequent on irrigation. The area afflicted with the injury, though not made clear, is considered to be quite extensive. Aspiring after economic stabilization of local farming villages, the government plans to effect, under the Fifth Five Year Plan, land improvement works covering an area of 300 to 400 thousand ha of existing farmland including areas afflicted with salt injury. However, the planned agricultural modernization will not be an easy task becasue improvement of alkaline soil entails the following problems.

i) Shortage of suitable hydrological data (incl. data on temperature, rainfall and soil) calls for collection and perfect consolidation of all the necessary basic data.

ii) Most of the existing canals are not lined and subjected to a large percolation loss. The government's subsidy should be granted so that at least main and lateral canals will be lined in future.

iii) No revision has been effected to the former project at all.

While solution must be brought for all these problems, there is another important question, i.e., determination of the crop-wise water requirement which bears closely on irrigation improvement plans. In mapping out a large scale development project in Iran, it is often the case that the empirical formulae of Blaney Criddle and others are applied to the meteorogical observation data of neighbouring cities to obtain the values of sunshine and temperature, and the crop coefficient is usually the value calculated from the table applicable to the dry zone lying in the approximately same latitude in the United States. Water requirement can be estimated with ease by this method, but since this method is less reliable than the actual measurement method, actual water requirement should be measured to effect correction to the calculated value and assure that an optimum amount of irrigation water will be supplied at the right time.

To put in other words, crop coefficient, K, which is used for calculation of the water requirement should be checked against the measured meteorological data in the project area (e.g., rainfall, evaporation, humidity, temperature, sunshin, wind, etc.) and against the water requirement measured by means of a lysimeter in experimental cultivation in order to establish the standard water requirement of various crops in Iran. This process cannot be dispensed with for Iran's future irrigation improvement plans.

It is equally important to study the soil moisture extraction pattern for each crop and decide on the irrigation interval. This is necessary for determination of the discharge of irrigation water to be supplied each time and establishment of the water management standards for upland field irrigation.

3-2 Recommendations

With the project completion scheduled for 1977, the mission considers that the pilot farm's activities should primarily be intended for practical development purposes. For future improvement of farm management techniques, however, the pilot farm will be also required to conduct the necessary experiments and research works as well as to render various services. It is expected that the outcome of experiments attained at the farm will be applied at trial plots and demonstrated at model farms together with the improved farming and irrigation techniques. The outcome of experimental cultivation will be diffused among farmers through extension activities, but a substantially long time will be required before the extended new techniques yield fruitful results. Since the pilot farm should carry out activities meeting practical development purposes in parallel with experiment and research activities, the farm will be required to introduce and extend improved farming techniques (including irrigation techniques) applied in other areas having similar natural conditions as the district in order to raise the productivity of crops, particularly summer crops. This, however, will inovlve the problem of improving the farm management pattern.

The government is hoping to attain increased meat production through improvement of farm management centering on livestock raising. The mission considers that the best plausible way to meet this purpose is to breed livestock by supplying combined feed of natural feed and forage crops. However, livestock breeding by this method will call for surveys on the quality and quantity of the existing feed resources and determination of the planted area of forage crops related directly therewith, as well as for examination of the farm management pattern which leads to the problem of economic feasibility.

In the past years, irrigation in the district used to be conducted only for winter crops which were harvested about three times in two years by farmers who are on a low level of edcuation and adhere to the traditional and extensiving farming practices. Therefore, it is not an easy task at all to enlighten and train these farmers until they learn to operate entrepreneurial agriculture on a profitable basis. However, since this is one of the major objectives of the Sistan Project, the mission recommends that a Farm Management and Land Use Improvement Section be established within the pilot farm.

The section is to be charged with the task of studying the economic advantages of various patterns of land use and agricultural management in order to establish the farm management pattern best suited to the district. The Extension Section of the pilot farm should not limit its activities to mere extension services. The mission recommends that a technical training centre be established within the section to provide training and education to young key farmers in farming techniques, operation of farming machines and equipment and water management techniques. The mission also considers it advisable to establish an agricultural high school attached to the section for education of youngsters in the district.

Biliography:

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IV. SOIL AND FERTILIZER

IV. SOIL AND FERTILIZER

4-1 Classification of Soils

The whole country is partitioned by the Elburz mountain range and the Zagros mountain range, and the central plateau between both mountains consists of the saline, sandy and rock desert and many mountain ranges embraces a number of basins formed with various depositions. More than 50% of the country's total land area is occupied by mountain ranges and waste lands.

The country can be geographically divided as follows from south to north.

1. Khuzistan plain
2. Folded zone
3. Iranides
4. Central plateau
5. Elburz mountains
6. Turkeman-Khursan mountains
7. Caspian littoral

Basic rocks such as limestone, shale, sand stone, tuffs and marls prevail in all these zones where various types of soils are found widely distributed by the functions of climate, vegetation, topography as well as many years of artificial effects such as plowing and irrigation.

According to the Soil Institute of Iran which is currently engaged in the soil surveys and classification, the soils in Iran can be topographically classified into the following four types.

1. Soils of plains and valleys
2. Soils of the plateau
3. Soils of Caspian piedmont
4. Soils of dissected slopes and mountains

Each of these four soil types is further divided into sub-groups. For example, soils of plains and valleys shown above are sub-divided as follows.

I. Soils of Plains and Valleys

Soil Association No.	Soil Type
1	Fine-textured alluvial soils.
2a	Coarse-textured alluvial soils.
2b	Sand dunes (including coastal sands).
3	Low humic gley, humic gley and half bog soils.
4	Solonchak and solonetz soils (including gypsum soils).
1-4	Saline-alkali soils.
3-4	Salt-marsh soils.

Five of the above-listed soil types, i.e., Soil Association Nos. 1, 1-4, 2b, 3-4 and 4, are found prevalent in Sistan plain which is the alluvial zone of the Hilmand river flowing from Afghanistan and is known to have been the country's granary zone about thirty years ago. The plain is composed of fine-textured alluvial soils of relatively uniform grain size.

The annual rainfall in the plain is less than 50 mm. This meagre rainfall, combined with the high atmospheric temperature and low humidity, makes the plain an arid zone where the annual evaporation reaches as high as 5,000 mm. Hence, saline contents of soil are concentrated on the ground surface by the evaporation of soil moisture and rise of groundwater level, forming the so-called saline alluvial soils. Since the soils in the plain were formed by parent rocks rich in salinity, salines are found in the soil without being leached.

Soils of this type transform into solonchak and solonetz soils in river basins and irrigated areas since evaporation of saline water gives rise to the accumulation of large volumes of salines on the ground surface. Particularly in the Sistan's basin where irrigation water can be drawn with relatively ease, widespread distribution of solonchak soil can be observed. On the surface of the dry saline soil can be often seen white saline layers (commonly called white alkali). The pH value of such saline soil ranges from 7 to 8.5.

The step that follows the increase in soil salinity is called the soil alkalinity stage in which the surface salines are composed of carbonate and bicarbonate and show a high alkalinity ranging from 8.5 to 9.0 in pH value. Dark coloured humic material produced by decomposition of residual plants is soluble in alkaline solution and presents black colour when it covers the ground surface. This sort of soil, commonly called black alkali or solonetz soil, is found in the area where the Sistan's groundwater level is shallow. The high alkalinity of solonetz soil makes it extremely difficult to cultivate crops. Areas covered with this type of soil are extremely poor in soil fertility and cannot be turned into arable land without soil improvement.

In the flood season when the Hilmand's water level rises, its water floods over the banks and collects in the low-lying area in the west of Sistan plain, forming a large swamp called Hamun-E-Hilmand. The swamp is said to cover a distance of 100 km from north to south and 30 km in the east-west direction. In summer, the swamp dries up due to high temperature and low humidty and creates salt marsh soil. During the flooding season, however, marshy weeds, particuarly reeds, grow in this area. The reeds growing in this area are important feed for raising sheep. The soil in this swamp area is not suited for crop cultivation so that its improvement into arable land is not considered.

Sand dunes distributed within certain areas are one of the soil type which is impeding agricultural development of Sistan plain. The sand dunes, created by wind erosion, not only reject any attemp to transform them into arable land, but are also largely retarding farmers' efforts for satisfactory preservation of cultivated land and maintenance of irrigation and drainage canals. The strong north wind blowing throughout the year across Sistan plain carries silt fraction from fare landes devoid of vegetations along former river basins, forming large and small sand dunes.

As described above, Sistan district is covered with soils which are all not suited for cultivation. Unless suitable soil improvement work is effected, it is practically impossible to raise soil fertility.

4-2 Physical and Chemical Characteristics of Soil in Sistan District

The Soil Institute of Iran is now carrying out soil surveys in Sistan district. The following description deals with the physical and chemical characteristics of soils in Miankangi area located in the northeastern part of the district as disclosed from the survey data of the said institute.

Miankangi area is an alluvial zone of the Hilmand river and soil layers in the area are composed of sediments deposited to a depth of as large as 5 m. The soil texture is characterized by the prevalence of silt fraction. The distribution percentage of lands with different soil textures are as shown below.

Silt loam - 47.0%; Silty clay loam - 16%; Loamy sand - 13.0%;
Sandy loam - 13%; and others.

Soils in the area are mostly silty and friable so that they are considered to be easy to plow. The bulk density of soil is 1.5 g/cm^3 and the water retaintivity varies by soil texture. Available water is 4.5% for loamy sand, 7% for sandy loam, 18% for silty loam, and 21% for silty clay loam, indicating that the retaintivity rises with the increase of clay content. The difference in water retaintivity must be given careful consideration in estimating the irrigation water requirement and determining the cropping pattern. The mission considers it essential to prepare a further detailed map of soil texture distribution map for future agricultural development.

Salinity is a problem which is confronted with not just in Miankangi area but in the entire Sistan plain. The electric conductivity expressed in percentage ratios by soil layer in Miankangi area is a tabulated below.

Electric Conductivity mmhos/cm	Soil layer		Salinity
	0 - 50 cm	50 - 100 cm	
0 - 4	35%	44%	Non Saline
4 - 10	24%	26%	Slightly Saline
10 - 20	15%	17%	Saline
20	26%	13%	Very Saline

Source: Sistan Ditrict Development Agency

As is clear in the above table, saline soil accounts for 65% of all soils and only 35% of the area can dispense with salinity improvement. With its former river course completely buried now due to wind erosion, Miyankangi's irrigation area is found only in the basin of the Parian flowing along the Iran-Afghanistan border so that the area is considered to embrace relatively small number of zones affilicted with saline accumulation due to irrigation and up ward movement of groundwater. In the basin of the Sistan river, on the other

hand, heavier saline accumulation takes place due to irrigation and flooding of river water, with white alkali observed at many places.

It is generally accepted that electric conductivity affects the growth of plants in the following five stages.*

1. If the conductivity ranges from 0 to 2 mmhos/cm, it gives no effect on the growth of crops.

2. If the conductivity ranges from 2 to 4 mmhos/cm, it gives effect on the growth of susceptible crops.

3. If the conductivity ranges from 4 to 8 mmhos/cm, it affects the growth of ordinary crops.

4. If the conductivity ranges from 8 to 16 mmhos/cm, only salinity resistant crops can be cultivated.

5. If the conductivity surpasses 16 mmhos/cm, growth of virtually all crops becomes impossible.

*Saline and Slkaline Soils; U.S.A., Harod Book, No. 60, 1954.

On the basis of the above criteria, it can be said that soils having an electric conductivity of more than 4 mmhos/cm make it difficult to introduce any kind of crop unless alkalinity is reduced. If crops are to be growth in such soils, salt leaching, soil dressing and application of chemical materials become a prerequisite to satisfactory soil amendment. Salines in the soil can be broadly considered in two categories. The first type is the top-layer leaching type which is characterized by the conspicuous accumulation of salines in the subsoil and by the existence of nonsaline surface soil having a thickness of 0 to 50 cm and an electric conductivity of less than 4 mmhos/cm. This type of soil is found in irrigation areas and is created by the leaching of salines into the subsoil. But if irrigation is suspended or drainage is conducted sufficiently, white effloresce is formed by evaporation on the surface of this kind of soil. In areas covered with this type of soil, therefore, irrigation and drainage work should be conducted perfectly in prevention of resalinization. The second type is the whale-layer saline type. Entire soil layer of this type has a high electric conductivity, but its surface soil down to 50 cm from the ground surface generally shows a higher salinity than the subsoil. Soil of this type is widely distributed in non-irrigated areas where the ground surface is covered with thin white effloresce of salt crystals. In such areas, no crops can be cultivated without soil improvement by salt leaching. Since such saline soil is widely distributed in Miankangi area, construction of irrigation and drainage canals in future should be preceded by salt leaching for soil improvement.

As for the soil alkalinity, most soil types show a pH value of less than 8.5, suggesting that strong alkaline soils are hardly found in the area. The strong alkaline soils referred to here indicate black alkali or solonetz soil which contain basic salts such as sodium carbonate. Soils registering a pH value of 8.5 or larger occupy only about 10% in Miankangi area, but it is estimated that this percentage will show some increase in the basin of the Sistan river.

The carbonate content of soil which is closely related with the salinity and alkalinity of soil is very high. Soils in the area contain as much as 8 to 35% (average: 21%) of calcium carbonate and magnesium carbonates which are mixed with sand, silt and clay fractions in the soil in the form of nodules and flecks. These carbonates are not soluble in water without CO_2. Since soils in the area have a small content of water and organic materials for one thing and CO_2 production is limited due to inactivity of soil microorganisms for another, it is considered that the leaching process of carbonates is very slow.

4-3 Soil Fertility in Sistan District

The stern climatic condition of Sistan district makes the growth of wild plant very difficult, not to speak of the cultivation of crops. Residues of harvested crops and wild plants have long been used to the maximum extent by local inhabitants as fuel or feed. Having been thus harnessed over many years in the past, soils in the district are losing nutrients and their fertility on the rapid decline.

The average organic matter content in the soil is 0.8% (0.5% in terms of carbon content), which clearly points to the meagre accumulation of humification process. The nitrogen content of soil is decreasing year after year. If high productivity is to be maintained in the district, regular application of nitrogen fertilizers and voluminous input of animal manure will be required so as to restore the soil fertility.

The available phosphoric acid content in the soil generally appears to rise with the increase of the clay content, and tends to show a higher value in the surface soil than in the subsoil. Since soils in a dry area are alkaline, it is quite plausible that the phosphorus content of the soil will turn into non-effective phosphoric acid in Sistant through combination with calcium carbonate and formation of the tricalcium phosphate which is not soluble in water.

The available potassium content in the soil decreases from the surface soil to subsoil and in addition, the potassium content tends to be affected by the soil texture. The available potassium content generally increases with the clay content. The effect of clay content on the potassium content is conspicuous with the exchangeable potassium. The available potassium content (me/100 g soil) is 0.20 for loamy sand, 0.27 for sandy loam, and 0.47 for silty loam. In a dry area, potassium loss due to leaching is limited and deficiency of basic potassium rarely occurs becase soils are alkaline. In Sistan district, therefore, potassium requirement can be fully satisfied without applying fertilizers.

Hence, it follows that nutrients required for improving the soil fertility are nitrogen and phosphoric acid and these can be supplied by a suitable fertilization method. It may be added that minor elements such as boron are also deficient for cultivation of certain specific crops.

The mission wishes to point out here that fertilization in a dry area could lead to a harzardous result if no irrigation water is supplied. Experiments conducted by the Soil Institute of Iran disclosed that fertilizers during the crop growing season in areas where the rainfall is less than 300 mm produced minus effects. This finding can apply to Sistan district whose annual rainfall is less

than 50 mm. For cultivation of summer crops, therefore, the fertilization standards should be established with due consideration given to the supply of irrigation water. The mission is of the opinion that application of fertilizers should be studied for augmented production of winter crops alone for some time to come.

The data of past fertilization tests conducted in Iran indicate that the crop yield rate rises with the heavier application of nitrogen and phosphoric fertilizers. The increase rate of yield, however, naturally varies by the type of soil. To cite a few examples, the prominent yield increase of wheat in Ahwaz and Machad where the soil is very poor was attained by application of 60 kg/ha of N and 30 kg/ha of P_2O_5, and the high yield rate achieved in two other fertile areas, i.e., Varamin and Esfahan, is ascribable to heavier dosage of fertilizer application and frequent supply of irrigation water. The effect of fertilizer application varies by the kind of crop to be grown, type of soil, pattern of rotation cropping, and introduction of irrigation farming. Fertilization techniques should therefore be established so as to be compatible with the climatic and farmland conditions in respective areas.

The following table shows the result of an analysis conducted on the water quality of the Hilmand river, the natural source of nutrients supply.

Location of Sampling	Date of Sampling	pH	Total Soluble Salts		Meq/					
			P.P.M.	E.C. x 106	Ca	Mg	Na	HCl_3	80_4	Cl
Near dom	2/4/59	8.4	25.8	42.9	1.10	1.15	1.30	2.35	0.99	0.76
do	7/9/59	8.7	23.6	32.2	1.05	1.50	0.72	1.60	0.74	0.60

As is clear from the above table, the Hilmand's water has an extremely large content of totally soluble salts of which basic ions occupy a large percentage. Supply of such water for irrigation will undoubtedly accelerate the accumulation of alkaline contents in the soil. Since the table does not show the contents of N, P and K, the river's water quality will have to be put to a close analysis with respect to irrigation and drainage to clarify the process of supply and leaching out of nutrients.

4-4 Soil Conservation

The strong northe wind blowing in Sistan district in summer that lasts from mid-June to mid-October produces notable wind erosion in the entire district. Large sand dunes formed by wind erosion are found along the former river course of the Niatak in Miankangi area, whereas the crescent-shaped sand dunes are distributed in Dudi area extending along the lower reaches of the Sistan river. It is considered that soil particles carried by wind erosion are composed chiefly of silt fractions. Heavy wind erosions are observed in bare land devoid of vegetation. Sand dunes do not stay still but they move each year. Large sand dunes are said to migrate 110 m and small one as much as 250 m each year, causing devastation of farmland, canals and even houses. Areas liable to form sand dunes by wind erosion are bare land with no vegetation cover. In Sistan district, areas with plant cover are on the

decrease year after year because trees have been cut down arbitrarily as fuel and vegetation has always been vigorously eaten away by sheep. To prevent the disasters of wind erosion, every effort should be directed towards restoring lost vegetation covers and and creating new ones by introducing suitable crop rotation patterns. At the same time endeavours should be made for systematic creation of windbreak forests and windbreak fences. Vegetation in a dry area like Sistan district involves many difficulties due to the lack of water. A suitable irrigation system should therefore be constructed in order to establish an efficient water utilization plan under which augmented crop production and revegetation will be brought to a reality.

4-5 Land Classification

Farmland in Iran is classified into four classes on the basis the aforementioned soil characteristics, particularly the soil texture, drainability, salinity, alkalinity, topography and soil erosion.

In Sistan district, Class I land which is most suited for agricultural production can be hardly found and land belonging to the other three categories are widely distributed. At present, however, distribution of these three categories of land has not yet been brought to light. Land surveys are therefore a pressing need in the district not just for clarification of land class distribution but also for mapping out irrigation and land use plans.

4-6 Problems Entailed in Soil Improvement

The problems of soil and fertilization application in Sistan district are basically common to those encountered agriculture of arid zone in the world. One of the most basic and outstanding problem to be solved in the district in the immediate future is the soil salinity. Basic studies on this subject are just too deficent at present and should therefore be enhanced in the coming years. At the same time, soil surveys including studies on phiscal and chemical properties of soil should be set afoot for the purpose of developing applicable salt leaching practices. Findings of these studies and surveys will have be put to a rigid instruction for establishment of a suitable soil improvement method as well as for preparation of an appropriate land use plan based on the idea of "right crop at the right place."

The low soil fertility in the district also makes it an imperative to carry out proper soil conservation and establish suitable fertilization techniques. By reason of the stern dryness of the district, development of fertilization techniques for application to summer crops may be justifiably withheld, but improvement of fertilization techniques for irrigation farming is a subject that cannot be dispensed with for future agricultural development of the district. Fertilized farming of winter crops (particularly wheat) is conducted only by a fraction of farmers in Sistan district. If farming techniques are to be improved and extended among the district's farmers to make them take off from the prevailing extensive farming to the high productive farming, soil improvement and positive introduction of advanced fertilization techniques will be an indispensable factor.

Devastation of farmland due to wind erosion shows sign of aggravation each year on account of the district's severe climatic condition. Actual state and mechanism of land erosion should therefore be made clear, with special weight attached to erosion preventive measures such as introduction of crop rotation, vegetation of uncultivated land, creation of windbreak forests, and prevention of over-grazing.

To bring solution for the above-mentioned problem of soil and fertilization, it is necessary to make a detailed and thoroughgoing soil survey and clarify the phyisical, chemical and biological properties of respective soil types so as to be able to establish the most adequate farming techniques on the basis of the soil-plant-animal relations. The mission wishes to point out that stablized agricultural production and progressive human activities can never be expected under the restraints of severe climatic condition without proper soil conservation measures and systematic water utilization plans.

V. CROP CULTIVATION IN SISTAN DISTRICT

V. CROP CULTIVATION IN SISTAN DISTRICT

Description in this chapter deals with the kinds of crops being cultivated and farming practices currently adopted in Sistand district as well as with the possibility of introducing new crops. Needless to say, crop cultivation in any area is an activity based on a number of given production factors in the natural, socio-economic as well as living environments of that area, and this principle applies to Sistan district. Hence, evaluation of the existing state of crop cultivation in Sistan district must necessarily be preceded by the clarification of the district's natural and socio-economic conditions, and improvement of these conditions is the essential prerequisite to advanced farming practices in the district.

In this chapter, therefore, the existing state of land use and crop cultivation in the district will be dealt with in the first place, followed by the general condition of the prevailing natural and socio-economic conditions, then by the farming practices currently adopted, and finally by the problems and improvements of farming techniques.

5-1 General Condition of Land Use and Crop Cultivation

The Sistan Project Area covers Sistan district composed of Posht-AB and Shib-AB areas and Miankangi area. The total project area is 250 thousand ha, of which 170 ha is covered by Sistan district and 80 thousand ha by Miankangi area. Cultivated land area covered by the project is said to be 90 thousand ha, of which 70 thousand ha is embraced in Sistan district and 20 thousand ha in Miankangi area. Table 1 shows the existing state of land use and crop cultivation in Sistan district. Land use and crop cultivation in Miankangi area is considered to be in the approximately same state as in Sistan district,

Single cropping in two years or "winter cropping - fallowing in summer - winter cropping" is the general land use pattern prevalent in the project area. With the double cropping taken at 200%, the cropping ratio of both summer and winter crops is as low as about 67%.

A closer look at Table 1 reveals that as much as 33% of the project area is perpetually fallowed. Excluding this 33% fallowed land, Sistan district's cultivated farmland area is 47,000 ha, of which 42,600 ha or about 90% is cultivated for production of winter crops (such as wheat, barley, cumin, alfalfa, persion clover, fruit trees and vegetables) and 7,100 ha or 15% for production of summer crops (such as sorghum, beans, melons, cotton, alfalfa, fruit trees and vegetables).

Wheat is grown for manufacture of bread, the staple food of farmers, whereas barley (green cut or ground grain) is cultivated as forage crop. These two occupy the majority of the crops cultivated in the area. Cumin, a condiment crop grown in winter is one of the few cash crops and it is exported to Pakistan and other countries. Cotton grown in the project area is a local variety which is poor in quality and low in commercial value. Vegetables include melons, water melons, egg plants, cucumbers, turnips, spinach, lettuce, cabbage, leek, radish and shallot, etc. Fruits produced in the project area include grapes and pomegranates, etc. Forage crops such as alfalfa and

perusian clover are dried and fed to domestic animals as winter roughage. Vegetables, fruit trees and forage crops are cultivated on a small scale inside earth walls constructed to keep sheep away.

Yield per ha of all the above-mentioned crops is invariably very low, registering 1 ton for wheat and barley and 3 to 5 tons for forage crops. In addition, both the farm income and gross product value of all the crops are also very low.

This extremely poor productivity is assingable to the stern natural conditions and stagnated improvement of socio-economic conditions. The restraubts of these adverse environmental conditions on agricultural production will be introduced in the following pages.

5-2 Restraints of Natural Conditions on Agricultural Production

Sistan district, situated in the southeastern part of Iran between lat. 30°31' and 30°31' N and long. 61°31' and 62°E, is a deltaic alluvial plain formed by the Hilmand river which rises in Afghanistan, and has an elevation of 460 to 500 m.

The district has the so-called continental dry climate characteristic to Near and Middle East. The climatic features of the district will be better understood from Table 2 in which a comparison is made with Kagoshima(Japan) lying in the approximately same latitude as the district. The maximum daily temperature is high throughout the year. During the period from April to October, in particular, it rises beyond 30°C, and in the three-month period from June to August, it goes up to as high as about 40°C. Table 2 shows the monthly average values of daily temperatures and does not therefore that the temperature occasionally rises to about 50°C in summer. Another outstanding temperature characteric of the district is that the temperature difference between days and nights is fixed at 12 - 16°C throughout the year. This temperature range is larger than that observed in summer in Japan.

Annual rainfall is limited to only 45 mm, so that supply of irrigation wa water is the indispensable prerequisite to cultivation of any crops.

Relative humidity in the district is extremely low in summer, while the annual evaporation is as high as 5,000 mm. This adverse condition is made worse by the strong wind blowing in summer for about three months at a velocity of 15 to 20 m and carrying sand particles. During the three-month period, above mentioned the wind repeats the recurring pattern of blowing for two days on which is blows from about 10:00 a.m. to about 4:00 p.m. and subsiding for the next one day. The wind blows from the north or northwest throughout the year.

Evaporation in summer is made extremely large by the high atmospheric temperature, low relative humidity and strong wind.

Irrigation water is drawn from the Sistan and the Parian which are both tributaries of the Hilmand river. Irrigation water drawn from these rivers can cover only about a little more than 10% of farmland area in summer because

the Hilmand's discharge declined after 1954 when Kajakai dam was constructed on the Afganistan side of the river. From winter to spring, however, the Hilmand has an abundant discharge so that farmers are able to supply sufficient irrigation water for cultivation of winter crops and store surplus water in fallowed area. But due to the absence of drainage facilities, the surplus water thus stored evaporate in summer, with salines accumulated on the surface soil. This practice, continued over many years in the past, invited the conspicuously high soil salinity, whereby about 33% of farmland is now left perpetually fallowed. Water management including the government controlled water distribution practices is not conducted along a scientific line, and irrigation water in summer is usually drawn by a handful of large and influential farmers in respective villages. Such being the situation, irrigation farming of summer crops is simply a matter of impossibility for general farmers.

Shortage of irrigation water in summer, combined with the lack of irrigation techniques on the part of farmers, gives rise to increasing soil salinity (saline crust is observed on the surface soil even in cultivated farmland area), impeding satisfactory growth of crops. The pH value ranges from 7.0 to 10.0, soil texture is either sandy or silty, and groundwater level is 40 to 50 cm in spring and 120 to 200 cm in summer.

5-3 Socio-economic Restraints on Agricultural Production

The socio-economic conditions affecting agriculture, the most important industry of Sistant district, can be summarized as follows.

(i) Land Ownership

At present, 60% of farmers own an operational holding of less than 8 ha, 28% 8 to 40 ha, 7% 40 to 120 ha and 5% more than 120 ha. It is expected, however, that upon completion of the Third Land Reform Plan now in progress, the greater part of farmers will have an operational holding of 5 to 6 ha. It may as well be added that the crop-sharing system based on the land ownership has almost disappeared in Iran.

(ii) Water Rights

Irrigation water drawn from rivers can be obtained against payment of Rls 40 per ha in winter. In summer when water falls extremely short of demand, however, irrigation farming is conducted only by a few influential farmers and general farmers have no access to water. General farmers cannot afford pumping irrigation either because it costs as high as Rls 800 in winter and Rls 1,100 in summer per ha.

(iii) Electrification

Iranian rural communities are far from electrification with the present propagation ratio of electrict light being as low as 0.3%.

(iv) Farm Household Income

The annual income per farm household is Rls 8,000 (32 thousand yen)

and it is said that the recent years have seen increasing outflow of rural population into Caspian sea regions and Gorgan. Capital accumulation by farmers is therefore considered virtually negligible.

(v) Education

The illiteracy rate in whole Iran is about 80%, and practically most grown-ups in rural communities are illiterate. However, by the recent construction of many primary schools where teen-agers in higher age groups are receiving primary education, it is expected that there will be increased numbers of educated young farmers in Iranian rural communities.

(vi) Transportation and Market

The greater part of agricultural products are consumed within Sistan district, though part of them are sold at bazaars in Zabol and Zahedan. Major products sold at these bazaars are sheep, beef, wheat, melons, and grapes, etc.

Roads linking Zabol with villages and Zahedan are not paved. Passage on the roads within Sistan district becomes occasionally impossible due to sand dunes and flooding of irrigation water. The existing road condition of the district is needful of much improvement for future transportation of agricultural products. At present, most farmers resort to camels and donkeys for transportation of their farm produce.

(v) Extension of Advanced Farming Techniques

The agricultural experiment station and the expeximental farm established in Zabol and Adimi respectively by the government are not performing the expected functions. One of the causes for this is the shortage of water. Another cause is the delayed improvement of the district's natural and socio-economic conditions which made the activities of the two establishments rather irrelevant to the actual farming practices in the district.

The existing situation of rural communities described above and the stern natural conditions make it prohibitive to introduce and extend new and improved farming techniques or to create advanced rural communities unless some daring improvement measures are taken.

5-4 Existing Situation of Crop Cultivation

Crop cultivation generally resorts to human labour and animal power (draft cattle). 165 tractors introduced ten years ago have gradually decreased in number due to the poor road condition and high maintenance cost which farmers could not afford. At present, only a limited number of these tractors are used for plowing, levelling and threashing.

Manure (sheep dropping) is applied for fertilization, and virtually no chemical fertilizers are used. Agro-chemicals are applied only on very limited occasions.

Wheat and forage crops are cultivated as described below.

(i) Wheat

Most of wheat varieties grown in the district are local varieties such as Bolani, Sharough Shali, Sorkh Kosheh, Lubatak, Den Dan Shorter, of which the former three have a higher yield rate. Farmers purchase wheat seeds from influential farmers who own seed growing farms.

The first plowing is conducted in the June - August period and seeds are sown between the end of September and December (seeds are sown up to February in certain areas). Seeding is preceded by the supply of irrigation water and second plowing. Seeds are sown at a rate of 80 kg per ha in the September -- October period, 100 kg in the November - December period, and 150 kg in the January - February period. After seeding, seeds are raked and then covered with soil, with no further care taken of the farm. Irrigation water is supplied by the basin irrigation method once before seeding and about three times after seeding for six hours (half a may) per 3.8 ha (sahm) each time.

Harvesting is conducted in May by manual labour. Harvested wheat is threshed by the trampling method using a tractor or a draft animal. After harvesting, sheep are driven in the field to let them eat the stubbles and their manure is used as fertilizer.

(ii) Forage Crops

Roughage fed to sheep throughout the year consists of the following. Reed growing around hamuns (lakes) in the March - May period; wheat stubbles, unthreashed and ground barley grains or green cut barley in summer; and dried alfalfa and persian clover or wild grass in winter.

Alfalfa seeds are sown in spring of autumn, and new seeds are sown in six to seven years of continuous harvesting. The harvesting frequency corresponds to the number of irrigation and averages three to four times a year. Yield per ha amounts to 5 tons in terms of dried alfalfa. Persian clover is grown as annual crop and harvested three to four times a year, and its yield per ha amounts to 3 to 5 tons in terms of dried clover. These two crops are cultivated in a small scale with earth walls constructed around the field to keep sheep away. Feeding of roughage therefore resorts mostly to natural grazing.

Plants growing wild in areas other than cultivated land include camel horn which camels eat, as well as kermak, savajke and reed which sheep eat. The last two of these wild plants grow around humun. Besides these, tamarisk and eucalyptus can be cited as trees resistent against saline soil and exhibiting vigorous growth.

5-5 Problems and Improvements of Crop Cultivation

(1) Farming in Sistan district is on the subsistence level because of the poor irrigation facilities and imperfect irrigation practices. The be more precise, wheat grown in winter occupies the greater part of the crops. Only 15% of all

the crops grown in the district are planted in summer. In addition, the yield per unit area is invariably low for all crops. This poor farming condition in Sistan district can be ascribed to the following four reasons.

1) Despite the fact that f rming in the district calls for sufficient irrigation facilities because of the negligible rainfall, no such facilities are available.

2) Improper irrigation method (irrigation not accompanied by proper drainage) has been followed over many years in the past, so that the soil salinity is high in the district.

3) Natural conditions in summer, e.g., temperature, wind, availability of water, are very severe.

4) The stern natural conditions add to the poor living conditions (low income level, poor living standard and low level of education) and delayed improvement of socio-economic conditions (i.e., transportation, welfare, marketing, distribution, social security system, etc.), so that farmers have not been able to accumulate capital, nor have they been offered extension services for cultivation of new cash crops and application of improved farming techniques. It is believed that farmers in the district lacked the forward-looking attitude for introducing advanced farming due to the pressure of such adverse conditions.

The Iranian government is planning to make the necessary capital input in order to bring solution for all these problems under the project.

(2) Improvement Measures of Iranian Government

For improvement of natural conditions, construction of a dam and irrigation facilities is now in progress to cover an area of 100 thousand ha in 1977. The construction work is being implemented in parallel with the farmland arrangement and consolidation plan under which the district's farmland area will be rearranged into plots of 200 m x 600 m (10 ha of upland field) and irrigation water will be supplied to each plot throughout the year. An open drainage network is also planned to be constructed to decrease soil salinity, and efforts will be made to reduce the groundwater level and maintain it at 1.5 to 2.0 m throughout the year. After completion of the construction work in 1977, therefore, the district will enjoy the benefit of scientific and rational water management. To prevent the hazards of wind erosion in summer, the government is planning mixed planting of tamarisk and eucalyptus along drainage canals.

Improvements of social conditions are planned to be effected under the Five Year Development Plan, which will include acceleration of land reform, establishment of a well organized and scientific water management system, diffusion of compulsory education, improvement of transportation network (construction of a railway line between Kerman and Zahedan, pavement of the roads linking Zabol with Zahedan and Mashhad, and construction of Zabol airport), creation of an agricultural cooperative association, establishment of a new pilot farm, and so forth. These improvement efforts will be coupled by the introduction of cash crops for raising the income level of farmers from the present level of Rls 8,000 (32,000 yen) to Rls 75,000 (300,000 yen).

The question then arises as to what crops will be grown in the district and what growth condition and yield they will exhibit when all these improvements are effected.

(3) Possibility of Accelerated Agricultural Production

The experimental data of the Agricultural Research Centre established at Safiabad, Khuzistan district, by Khuzistan District Development Agency provide the basis for studying the possibility of augmented agricultural production with account taken of natural conditions alone and disregarding socio-economic factors.

The activities at this 200 ha wide centre are intended for developing Khuzistan district through advancement of agro-business (for details of agro-business in the district, refer to the description given elsewhere in this (report). After completion of its irrigation and drainage facilities, the centre has been engaged for several years in various experiments and research activities. The scope of activities presently conducted at the centre include selection and breeding of varieties of fruit trees (e.g., olive, peach, apricot, plum, fig, grape fruit, orange, lemon, grape, etc.) and experiments on growing upland crops (e.g., sugar beet, sorghum, maize, oil seeds, wheat, barley, vegetables, etc.). The centre also has the soil section (which carries out studies on irrigation methods) and the livestock farming section.

Because the centre has continued scientific irrigation since it embarked on research activities, the soil salinity within the centre declined notably, now registering an electric conductivity of less than 2 - 3 mmho/cm. The centre's soil has a pH value of 7.8 - 8.2 and has a large K_2O content (190 ppm). Any crops capable of growing in soils having a pH value of 8 can therefore be cultivated at the centre, and they actually exhibit a high yield rate with no application of potassium fertilizer.

Table 3 shows a summary of cultivation methods of upland crops concluded to have been most desirable from the data of experiments conducted in 1970/1971.

Table 4 shows a comparison of climatic conditions between Safiabad and Zabol in Sistan district. The two places are approximately in the same latitude and have approximately the same temperature and humidity except that rainfall in winter is a little larger at Safiabad.

From Table 4, therefore, it can be inferred that if scientific water management is conducted and soil salinity reduced, most of the crops shown in Table 3 can be grown in Sistan district and will exhibit a high yield rate. It may as well be added that farm works can be put in practice systematically in the district because of its small rainfall, and this makes it possible to introduce mechanized farming with ease.

(4) Technical Studies and Extension

The natural and socio-economic conditions of Sistan district are about to be improved under the Five Year Plan. The government's plan to establish a pilot farm which will function to establish advanced farming techniques in

parallel with the improvement in natural and socio-economic conditions can therefore be fully justified.

The farming method, however, naturally varies by area depending on the kinds of selected crops, scale of farm management, means of farm works, marketing organization, and other socio-economic conditions. At Safiabad, for instance, the farming method is based on agro-business, which is quite divergent from the farming method to be established in Sistan district on the premise that farmers will be organized into an agricultural cooperative association. Hence, accelerated efforts should be made in basic researches as well as in the application of the outcome of such researches in order to establish farming techniques best suited for development of Sistan district.

The mission wishes to point out that the pilot farm should also perform the function of agricultural extension and training.

The description given above is based on interviews and data collected during the limited survey period. The mission is therefore of the opinion that the construction plan of the pilot farm and the necessary technical aid programme will have to be prepared on the basis of another closer survey which should cover natural conditions in summer, actual state of crop cultivation, and socio-economic conditions because no clear picture of these aspects could be obtained by the present survey due to its short period.

Table 1 - Land Use and Agricultural Production in Sistan District (1966)

Item	Area		Yield	Price	Product	Gross Product Value	Ratio
	ha	%	(ton/ha)	(Rls/kg)	(ton)	(Thousand Rls)	(%)
Total Area	146,000						
Arable Land Area	69,800	100.0					
Land Use							
(a) Winter Cereals	36,600	52.4				185,880	66.9
Wheat	28,200	40.4	0.9	6.0	25,380	152,280	54.8
Barley	8,400	12.0	1.0	4.0	8,400	33,600	12.1
(b) Winter Crops	500	0.7				10,500	3.8
Cumin	500	0.7	0.7	30.0	350	10,500	3.8
(c) Summer Crops	4,400	6.3				46,200	16.6
Sorghum	1,100	1.6	0.6	4.0	660	2,640	1.0
Pulses	600	0.8	0.3	12.0	180	2,160	0.7
Melons	1,800	2.6	12.0	1.5	21,600	32,400	11.7
Cotton	900	1.3	1.0	10.0	900	9,000	3.2
(d) Fodder Crops	3,300	4.7					
Alfalfa	500	0.7	hay 5.0		2,500		
Persian Clover	2,800	4.0	hay 3.0		8,400		
(e) Other	2,200	3.2				35,200	12.7
Fruits and Vegetables	2,200	3.2	-	16,000*		35,200	12.7
Total Planted Area	47,000	67.3				(277,780)	(100.0)
Fallowed Area (Winter)	27,200	39.0					
Fallowed Area (Summer)	62,700	89.8					
Perpetually Fallowed Area	22,800	32.7					
Cropping Intensity		67.3					

Notes:
1. All the values apply to Posht-AB and Shib-AB alone of Sistan district.
2. This table was prepared from the survey data of Sanyu Consultants Co.
3. The cropping intensity is the ratio of total planted area of both summer and winter crops to the total cultivated area, with double cropping intensity taken at 200.
4. 1 Rial = approx. 4 yen.
5. * Rls/ha

Table 2 - Comparison of Climatic Condition between Zabol and Kagoshima

Item / Month	Maximum Temperature (0°)		Minimum Temperature (°C)		Temperature Range (°C)		Mean Temperature (°C)		Monthly Rainfall (mm)		Relative Humidity (%)	
	Zabol	Kagoshima	Zabol	Kagoshima	Zabol	Kagoshima	Zabol	Kagoshima	Zabol	Kagoshima	Zabol	Kagoshima
Jan	15.8	12.0	1.6	1.8	14.2	10.2	8.7	6.6	6	75	74	76
Feb	17.1	13.1	4.9	2.7	12.2	10.4	10.9	7.7	22	116	76	73
Mar	25.6	16.3	10.6	5.6	15.0	10.7	18.1	10.8	5	149	65	74
Apr	29.7	20.6	15.0	9.9	14.7	10.7	22.3	15.1	6	228	58	77
May	35.1	24.2	20.4	14.4	14.7	9.8	27.8	19.0	0	249	47	79
Jun	39.4	26.9	24.2	18.9	15.2	8.0	31.6	22.6	0	454	36	82
Jul	40.4	31.1	27.1	23.4	13.3	7.7	33.8	26.8	0	343	32	82
Aug	39.0	31.8	25.2	23.5	13.8	8.3	32.1	27.1	0	220	30	82
Sep	35.4	29.4	19.6	20.3	15.8	9.1	27.5	24.4	0	213	36	80
Oct	29.9	24.7	13.5	14.0	16.4	10.7	21.2	18.9	0	120	49	76
Nov	22.6	20.1	6.8	8.8	15.8	11.3	14.7	14.0	3	90	64	77
Dec	17.0	14.9	1.7	3.9	15.3	11.0	9.4	9.0	3	79	77	77
Annual Average	28.9	22.1	14.2	12.3	14.7	9.8	21.5	16.8	45	2,337	54	78

Notes: 1. Zabol - Lat. 31°32' N, Long. 61°29' E, El. 480 m.
Kagoshima - Lat. 31°34' N, Long. 130°33' E. El. 5 m.

2. Values for Zabol are the means for 1963 - 1967 period obtained from the Research and Climatogical Division, Meteorological Departement, Ministry of Road, Iran.
Values for Kagoshima are the means for 1931 - 1960 period obtained from the 1970 edition of "RIKA-NENPYO", Japan

Table 3 - Cultivation Method Established by Agricultural Research Centre, Safiabad (Khuzistan District)

Kind of Crop	Variety	Preceding Crop	Optimum Seeding Period	Harvesting Period	Growing Period	Seeding Method	Amount of Fertilizer ($N-P_2O_5-K_2O$)
Wheat	Mexican wheat is desriable.	-	Late November - Late December	Late April - Early May	150 - 180 days	100 kg/ha, row spacing - 30 cm, drilling	125-90-0 kg/ha
Maize (Late seeding)	YUZP SC - 4 YUZP SC-48A	Cotton	Early August - Mid-August	Mid-December	120 - 130 days	50,000 - 60,000 plants/ha, row spacing - 75 cm	264 - 160 - 0
Sugar Beet	Dutch variety	Wheat	Early September - Early October	Mid-April - Mid-May	210 - 240 days	80,000 - 100,000 plants/ha, row spacing - 1 m, double	120 - 90 - 0
Oil Seeds							
Sunflower	NSP317, Majak, Orizont, etc.	Cotton	Late January - Late February	Late June	120 - 150 days	65,000 plans/ha, row spacing - 75 cm	120 - 90 - 0
Soybeans	Hood, etc.	Cotton	Late February - Mid-March	Late August	175 day	500,000 plants/ha, row spacing - 75 cm	120 - 60 - 0
Safflower	Local var. Araki 2811	Cotton	Late January Mid-February	Early July	155 days	200,000 plants/ha, row spacing - 1 m	120 - 90 -0

Notes:
1. Prepared from the data for 1970/1971 of Agricultural Research Centre, Safiahad.
2. Cultural methods summarized above are those which recorded the highest yield for each crop.
3. The preceding crops are those grown in the centre's farm.

Irrigation Frequency	Care of Field	Yield (ton/ha)	Quality	Problems
4 times		4.5 - 5.0 in grains		Variety, lodging and weeds.
10 times	Application of 3 kg/ha of Atrazin	11.4 in kernals 11.0 "		Cultivation possible after harvesting winter crops. Double cropping also possible.
15 times (12,500 m^3/ha)	Weeding, pest and disease control, and thinning.	70 - 120 (root yield)	Sugar content: 16 - 20% Purity: 85 - 95%	
10 times	Weeding and thinning	2.6 - 3.0	Oil content: 45 - 50% Protein content: 20 - 25%	Early harvesting to reduce damages caused by birds and shattering
12 - 14 times	Weeding, thinning and pest and disease control.	2.5	Oil content: 20 - 23% Protein content: 35 - 41%	Seeding not practicable after mid-May.
5 - 6 times	Weeding, thinning, inter inter-tillage, and pest and disease control.	3.0	Oil content: 23 - 40% Protein content: 18 - 23%	

Table 4 - Comparison of Climatic Conditions between Safiabad and Zabol

Item	Maximum Temperature (°C)		Minimum Temperature (°C)		Mean Temperature (°C)		Monthly Rainfall (mm)		Relative Humidity (%)	
Month	Safiabad	Zabol	Safiabad	Zabol	Safiabad	Zabol	Safiabad	Zabol	Safiabad	Zabol
Aug	48	39	21	25	34	32	0	0	28	30
Sep	43	35	16	20	29	28	0	0	33	36
Oct	40	30	11	14	26	21	2	0	37	49
Nov	33	23	11	7	22	15	11	3	51	64
Dec	24	17	4	2	15	9	61	3	70	77
Jan	27	16	4	2	14	9	7	6	62	74
Feb	12	17	1	5	11	11	31	22	69	76
Mar	28	26	7	11	18	18	71	5	59	65
Apr	28	30	10	15	19	22	97	6	72	58
May	40	35	17	20	29	28	1	0	44	47
Jun	44	39	16	24	29	32	0	0	34	36
Jul	47	40	21	27	38	34	0	0	30	32

Notes:
1. Safiabad - Lat. 32° N, Zabol - Lat. 31° N.
2. Values for Safiabad are those for 1970/1971 obtained from the data of the Agricultural Research Centre. As for the source of the values for Zabol, see Note 2. to Table 2.
3. In preparing the above table, fractions of 0.5 and over were counted as a whole, disregarding the rest.

VI. LIVESTOCK FARMING

VI. LIVESTOCK FARMING

6-1 Existing State of Livestock Farming in Iran

Livestock products acount for about 40% of the total value of Iranian agricultural production. In a number of development plans enforced in the past by the government, livestock farming always carried heavy weight and its development has been vigorously pushed forward. However, Iran's livestock farming has not pursued a smooth course of development due to the country's stern natural condition, particularly the adverse climatic condition which invites extreme shortage of water.

Since Iran has an extensive grazing land, the great majority of livestock are ruminant animals. At present, numbers of domestic animals count 29,000 thousand for sheep, 12,500 thousand for goats, 6,000 thousand for cattle, 40,000 thousand for poultry, and 2,100 thousand for donkeys used for transportation. Sheep are raised mainly for the purpose of obtaining mutton and secondarily for the purpose of obtaining wool, milk and hides, and they comprise a number of local breeds and their crossbreeds. Cattle raised in the northern and western parts of the country consist of a number of local breeds of European type (Bos taurus) and their crossbreeds, whereas those kept in the southern and eastern parts are mostly of the Asian type (Zebu). Cattle are raised to obtain beef in the first place, and sometimes used for drafting besides producing milk. In general, cattle raised in Iran are characterized by late maturity (23 - 24 months of growing period is required before mating), low milking capacity (annual milking capacity is less than 1,000 kg) and small weight (weight of an adult cow ranges from 250 to 400 kg). The state livestock experiment station is studying the adaptability of hybrids produced by crossing local breeds (Bos taurus type) with Holstein and Brown Swiss. The mission noted that F_1 produced at the station exhibit the effect of breeding to some extent. However, cattle breeding by general farmers is conducted only in limited area using imported frozen semen.

As for poultry, broiler production has become active in suburban areas of large cities in recent years. Breeding eggs of foreign types are incubated at Teheran and chicks are supplied to poultry farms throughout the country. Chicks thus supplied appear to be fattened fairly well.

Herbivorous animals are generally grazed to make use of natural vegetation, and alfalfa and perusian clover are to cover the shortage of natural vegetation. Concentrated feed is produced by combination of homemade feeds chiefly comprising barley, wheat, maize and oil cakes of different kinds which are produced in Iran and partly imported maize. It appears, however, that the amount of concentrated feed supplied to herbivorous animals is extremely limited.

Output of major livestock products is as follows.

180 thousand tons for mutton, 115 thousand tons for beef,

70 thousand tons for goat meat, 45 thousand tons for fowl meat,

2,000 thousand tons for milk, and 36 thousand tons for wool.

Demand for livestock products is on the steady upward trend with the increase of the nation's income. The growing demand is conspicuous with beef which has marked an annual gorwth rate of as high as about 8% over the past few years. Consequent on the recent shortage of beef supply and resultant price hike, the government is obliged to import 5 to 6 thousand tons of mutton each year. Since it is expected that the shortage of meat supply will be aggravated and force the government to import more meat than ever, augmented production of meat is a pressing need Iranian agriculture today.

(1) General Situation of Livestock Farming in Sistan District

Agriculture, particularly livestock farming, used to flourish in the approximately 250 thousand ha wide project area which is surrounded by the S Sistan, the Parian and Hamun-e-Hilmand. However, deposition of sand carried by rivers over the past few hundred years has turned the area into a desert where no sufficient water is available and soil presents high salinity. The consequent degradation of both farming conditions and living environments has invited continued outflow of the inhabitants to other parts of the country, making the district an underpopulated area. In addition, frequent drought damage inflicted in the past years on the livestock raising farmers has made the district's livestock farming quite inactive.

Under its Fourth Five Year Plan, the Iranian government plans to implement a large-scale agricultural development project in Sistan district. The government holds the view that livestock farming is the core of agricultural development of the district. It is evident that the government places much hope on the district's agricultural development and expects that it will turn into one of the major producing areas of meat which is acutely short of demand at present. For early materialization of this project, part of construction work for the necessary agricultural infrastructural improvement was started in 1972, and a huge capital input is expected to be made under the Fifth Five Year Plan commencing in 1973.

(2) Kinds of Animals Raised

Ruminant animals such as sheep, goats and cattale constitute the majority of livestock raised in the district, with sheep numbering 300 thousand heads, goats 168 thousand heads, cattle 46 thousand heads and camels 4 thousand heads.

Besides these ruminant animals, there are 21 thousand donkeys, 1 thousand horses, and 90 thousand fowls.

Sheep are composed of Balchi breed, Afghani breed and their crossbreeds. They not only provide milk for farmers' own consumption but are the precious source of cash income since they are sold to obtain meat. Goats are local breeds and crossbreeds having no particular names. They are raised chiefly to obtain meat and their milk is likewise consumed by farmers themselves. Cattle, commonly called "Sistan cow", comprise 70% of Zebu type and 30% of Bos taurus type and crossbreeds of the two types and are mo mostly raised to obtain meat. Althought there are some farmers who market cow milk, the dairy cattle raised in the district seem to have a very poor milking capacity. Bulls are generally castrated and used for drafting and then sold to meat merchants. Beef cattle marketed by the farmers in the

From spring to early summer, herd-boys drive them to the shores of Hamun-e-Hilmand where they feed on reeds and cattails with other herbivorous domestic animals. When the growing season of reeds and cattails is over, they are driven back to feed on wild grasses growing outside ckusters or on alfalfa, perusian clover and barley grown inside mud fences or near the clusters. However, these fodder crops are just too deficient so that the feed resources in this season are poor in both quality and quantity.

Cattle are usually raised by natural vegetation so that a semi-nomadic pattern prevails in the district, and the mode of farmers' life reflects such pattern.

(4) Feed Resources in the District

It is no exaggeration to say that the district's livestock farming is made possible by Hamun-e-Hilmand. Reeds growing around it not only high in nutritive value but also preferred by domestic animals to other grasses. It is believed that the Hamun-e-Hilmand can supply a large quantity of fodder enough for 100 thousand heads of sheep and 15 thousand heads of cattle annually. Wild grasses growing in the desert area are generally coarse, low in nutritive value, and found only sporadically. They take root deep the ground (some reaching a depth of 8 m beneath the ground surface) and exhibit strong resistance against drought. Some of the wild grasses often found in the desert area are "Camelhorn," "Kermack," and "Attroplex" which appear to belong to Leguminosae.

Although the natural vegetation described above accounts for the greater part of the feed for raising domestic animals, legumes are grown on a small scale in and outside each cluster, with barley stalks and leaves occasionally fed to cover the shortage of natural grasses and fodder crops. However, irrigation water for growing these fodder crops is available only to a handful of influential landowners.

Fodder crops plantes are alfalfa and perusian clover both belonging to Leguminosae. The ratio of the former's planted area to the latter's is 1 : 5 and this is because the latter is an annual crop and can therefore be readily incorporated in the rotation cropping in the small farmland. Alfalfa (a perenial crop of six to seven years) is reaped 4 to 5 times a year and produces a yield of 4,000 - 6,000 kg per ha in hay base, whereas perusian clover is reaped 3 - 4 times a year and its yield per ha is said to be about 5,000 kg in hay base. It is considered, however, that these fodder crops account for only about 5% of the total feed requirement in the district.

(5) Livestock Production

a. Milk Production and Dairy Products

Only cow milk is marketed in the district and processed into fresh milk, yogurt, butter, cheese and "Roghan" (milk oil) by small-scale processors in Zabol. Of these dairy products, "Roghan" enjoys the most stabilized demand while others are subjected to sharp seasonal fluctuation of demand. Zabol is practically the only place where consumers of fresh milk and yogurt are found. The producer's price of unprocessed milk is about 6 Rls/kg.

b. Meat Production

Livestock farming in the district aims primarily at meat production, but the productivity is rather low due to the poor physique of the animals and deficiency of feed. However, lambs shipped within one year after birth are evaluated highly because of their excellent meat quality.

c. Wool and Hide Production

Shearing of sheep is conducted in April and September each year and that of goats once a year. Wool production per head, however, is not very large. Production of hides and skins in the district is extremely small and the processing techniques are still on a very low level.

(6) Distribution of Livestock Products

The greater part of domestic animals produced in the district are shipped alive to wholesalers in Teheran and other major cities. At the state slaughterhouse in Zabol, 20 - 25 heads of sheep and 4 - 5 heads of cattle are slaughtered to supply their meet to consumers in Zabol and its vicinities. The slaughtering charge is about 60 Rls. per head of cattle and about 20 Rls. per head of sheep.

(7) Veterinary Organization for Disease Control

Since the district is very close to the Iran-Afghanistan border, it is subject to frequent spread of infections animals diseases. Diseases that often attack the district are enterotoxaemia and sheep pox and Piroplasmosis of cattle and sheep, but anthrax and foot and mouth disease also threatens to occur. For this reason, the veterinary clinic at Zabol is staffed by two veterinary and 12 vaccinators who are engaged in the preventive inoculation and injection of domestic animals. The live animals to be shipped from Sistan district to major consuming areas are kept at Zabol for about a week during which they are checked infection of any of the above-mentioned diseases. Checking of animals' health condition before they are slaughtered at the slaughterhouse is also made obligatory under the pertinent statutory provision. Thus, the district is fairly advanced in the veterinary organization of disease control but the mission received the impression that animal infections diseases are not completely controlled due to the shortage of experts and low technical level of farmers.

6-3 Problems and Future Course of Livestock Farming in the Development of Sistan District

Since the district's agricultural development project aims at (1) growth of owner farmers and elevation of their income level as well as (2) augmented meat production, the project should be planned from a long-term viewpoint and implemented step by step. There are two things to be done in the immediate future for successful implementation of the project, i.e., diffusion of education of local inhabitants and afforestation. The former cannot be dispensed with if advanced farming techniques are to be introduced and applied in an efficient way by farmers themselves, and the latter is the precondition for protecting the habitats of plants and animals against the stern natural condition.

district are usually very thin, suggesting the shortage of feed resources. Due to the lack of modern transport means, donkeys are indispensable in the district for carrying farm produce, fuels, daily necessaries, and they serve as important transport means of farmers as well. Camels are used for carrying various commodities to and from distant places. Poultry is carried out on a small scale, with a few chickens of local breed (egg and meat type) being kept at each farm household.

(3) Raising Pattern of Major Animals

a. Sheep and Goats

Since the poor vegetation in the district is suited for raising sheep and goats, they are kept by most farmers. These two kinds of animals are not k kept separately but usually raised to form a single flock. The number of sheep and goats owned per farm household averages 10 to 20 heads, though there are few farmers raising as many as 200 to 500 heads. Farmers usually have an mud made house with a garden compound surrounded by mud fences. Some tens to hundreds of such houses are found in each cluster where farmers are settled. However, shoep and goats are almost not raised in the cluster. Instead, herd-boys each driving a flock of sheep and goats owned by several farm households move within a substantially wide area locking for grazing land by season. The raising pattern generally observed in the district is as follows.

During the period from March to May when Hamun-e-Hilmand covers an extensive area (an area of about 300 thousand ha is covered by the lake when its water level rises to the highest), reeds and cattails growing around the lake are the best and most abundant feed for sheep and goats. Not only sheep and goats but the majority of other animals raised in the district are driven to Hamun-e-Hilmand and pass the said three months around it. During the June - August period when the temperature is high and strong wind blows, they are grazed in the barley or wheat stubble graging land near the cluster. In autumn, they are driven back to Hamun-e-Hilmand to feed on reeds. Reeds growing in this season are legeous and have a little digestable nutrient. When winter comes, they feed on wild grass growing near the cluster. Some farmers grow alfalfa, perusian clover or barley within mud fences to make up for the shortage of feed. In years when the vegetation around Hamun-e-Hilmand is poor due to deficient discharge of the Hilmand, herd-boys must drive their flocks to distant places to cover the shortage of feed. If a heavy drought attacks, driving the flocks to far places is of no use and farmers suffer serious damages. It is said that the drought of 1970 caused death of about 30 thousand sheep and goats in Sistan district alone. In sistan district, the mission came across a farmer who lost all the 70 sheep he owned during the 1970 drought, and is now making living by cultivating a small farmland on the commission basis.

b. Cattle

The number of cattle raised per farm household averages one to five, though some farmers own some ten heads of cattle. Like other domestic animals, cattle are not kept in barns. During the nighttime and winter, therefore, they are usually raised inside the mud fences. The raising pattern of cattle is as follows.

Both the education and afforestation efforts require a considerably long time before they yield the expected result.

The project entails many technical problems to be solved as well as ma many social problems which should be given consideration in the national development scheme, and solution must be brought for all these problems if the project is to yield the benefit that counterbalances the huge development fund. Accelerated agricultural production in the district calls for various incentive measures which should be carried out in a most effective way in accordance with the elevation of farmers' educational standards and with the changes in social structure.

The problems briefed above are described below in more detail in relation to the development of livestock farming.

(1) Agricultural development of Sistan district hinges on the success of the planned large-scale irrigation scheme. If cultivation of forage crops becomes possible as a result of the scheme, then the district's livestock farming will depend more on cultivated forage crops than at present and the prevailing semi-nomadic raising pattern will give place to a settled pattern. Since this will naturally be accompanied by the change of farmers' mode of life, jmprovement of the district's social structure will be greatly prompted. This factor should therefore taken into due consideration in designing the pattern of farm management.

(2) At the stage when a fair prospect is offered for forage crop production, breeding should be planned for each kind of domestic animal on the basis of a plan mapped out for utilizing forage crops, wild grasses and other feed resources.

(3) A farmers' organization like an agricultural cooperative association which functions in the interests of farmers should be created. Such an organization should be capable of bulk purchase of production materials such as farming equipment, fertilizers and seeds of forage crops and should also perform the function of collective shipment and sales of livestock products.

(4) As for increased meat production which is incorporated in the government's agricultural development scheme, either direct or indirect measures should be taken by the government to maintain the meat price at such a level that serves to stimulate the farmers' willingness for augmented supply of meat.

(5) The agricultural credit system should be reinforced in conformity to the government's development policy so that farmers lacking own fund will be provided, on reasonable conditions, with loans with which to bear their share of infrastructural improvement cost and cover the cost of farming equipment, animals, seeds of forage crops, fertilizers and so forth.

(6) One of the problems to be solved in pushing forward the district's agricultural development is the destruction of several infections diseases of domestic animals. The district's high occurrence ratio of animal infections diseases and its geographical proximity to the Iran-Afghanistan border make it imperative to carry out vaccination completely, conduct regular check-ups early discovery of disease-afflicted animals and apply the quarantine rules strictly to

strictly to animals transported from outside the district.

Supply of cultivated forage crops (particularly over feeding of legumes) is liable to cause various troubles of digestive organs. It will therefore be necessary to newly establish an animal infections disease control center and expand the existing veterinary clinic or establish a new one, and staff these establishments with larger numbers of veterinaries and technicians.

(7) When agriculture is settled and scale of management is expanded in future, unexpected water shortage or occurrence of pest or disease damage will result in serious production decline of forage crops, putting agricultural management in dire confusion. A feed storage system should therefore be established to provide against such a disaster. The mission suggests that dried grasses for emergency use should be produced at state farms including the existing pilot farm.

(8) Breeding is an essential prerequisite to efficient production of livestock products. It will therefore be necessary to establish a breeding station preferably equipped with the facilities for selecting crossbred breeds, breeding and distributing improved breeds of male animals, and producing and storing frozen semen for artificial insemination. The breeding station in Sistan district may not be demanded to exhibit all these functions, but it should have all the facilities required for breeding of domestic animals in the district.

VII. PILOT FARM CONSTRUCTION PLAN

VII. PILOT FARM CONSTRUCTION PLAN

In the belief that agricultural development of Sistand district calls, above all other things, for establishment and extension of farming techniques best suited to the district's natural conditions, the Iranian government planned construction of a Water Resource and attached equal importance to establishment of a pilot farm which would be engaged in various experiments and research activities and serve as the centre of extension services. It was from this conviction that the Iranian government requested Japan's assistance in the establishment and operation of the pilot farm which is expected to perform the following functions.

(1) The prime objective of the farm is to raise agricultural productivity to the planned level within the shorted period under the Sistan agricutural development project.

(2) The farm will be engaged in experiments and researches as well as in extension activities and seed multiplication.

(3) Experiments and research activities will cover not only crops but domestic animals as well, and will be intended for breeding crop varieties best adaptable to the district's conditions and for establishing their cultivation techniques.

(4) Extension services will be offered to the neighbouring farmers via various publicity means and media on the basis of the findings of experiments conducted at the farm. On this case, it is necessary to study the method on the technical extension service which is applicable for the farmer's standard of technique.

(5) Seed multiplication will also be based on the findings of the experiments conducted at the farm and will be intended for selection and extension of the varieties best suited in the district.

The pilot farm will be constructed on the area of left side bank of Zahak barrage, at a point very close to the base camp now under construction and only about 25 km far from Zabol. The farm will cover an area of about 150 ha. Water pumped up from Shahl canal leading from Zahak barrage will be drawn to the farm for irrigation and creation of a regulating farm pond. The farm will have test fields, office, experiment fields, livestock experiment station (provided with a grazing ground), and dormitory of the staffs.

VIII. BRIEFING OF SURVEY AND DISCUSSIONS

VIII. BRIEFING OF SURVEY AND DISCUSSIONS

In conducting the survey for Sistan district agricultural development project, the mission exerted every and consistent effort to get a clear picture of the existing state of Iranian agriculture and to obtain data for charting the course of its future development. However, due to the short period survey, the area covered by the survey was quite limited.

The mission was impressed by the agri-business in Khuzistan as it offered a promising prospect in dry areas in Iran. The pilot farm in Rasht area also attracted the mission's attention because it appears to present the problems in paddy rice cropping on the Caspian coast. A brief description of the survey conducted in these two areas will be given below together with the record of discussions held with the competent Iranian authorities before and after the survey.

A. Agri-business in Khuzistan

Khuzistan is situated in the southwestern part of Iran covers an area of 156,253 km^2 which is about one-twelfth of the country's total area. Facing Persian Gulf, the area has favourable geographical conditions, with the Karun and the Karkheh providing abundant water. In 1956, a survey was conducted for a multi-purpose development project under a contract concluded between the Iranian Ministry of Water and Power and Development and Resources Corporation of New York. The report on this survey states that the entire province was divided into 14 project areas and dam construction at 14 places was planned for hydro-power generation of 6.6 M.C.W and irrigation of 1 million ha farmland area. The natural condition of the area as obtained from the data of the Ministry of Economy is as follows.

"The climate of the whole area is that peculiar to desert areas, with the maximum atmospheric temperature in summer (June to September) ranging from 46 to 43°C and average annual temperature from 33 to 32°. In spring and sutumn, however, temperature is rather low, with the daily average of 15 to 24°, and it frosts occasionally in winter. Alluvial soils comprising mostly silt or silty clay loam prevail throughout the province, though heavian soil is found in the southernmost part of the area and sandy soil occurs in very limited areas. Most soil types are suited for irrigation. The whole area has a mild gradient of 1/600 from north to south. The plow layer has a thickness of more than 80 cm, so that any crops can be grown if sufficient water is supplied."

The first phase programme of the said multi-purpose development project was mapped out for construction of Mohamad Reza shah dam on the Dez river, a tributary of the Karun, for hydro-power generation of 520 thousand kW and irrigation of 126,465 ha land. This water utilization programme was brought to reality by the implementation of the Dez Irrigation Project and the Haft-Tapeh Sugar Cone Project. The latter project, commenced in 1958 for construction of a refinery and cultivation of a 2,599 ha farm, has progressed smoothly over the past years with more than 5,000 ha area being cultivated at present. The farm is expected to be expanded to 10,500 ha by 1973. The Dez Irrigation Project, on the other hand, was commenced in 1959 for irrigation of

22,260 ha area and completed in 1966. This was followed by the first expension plan whereby the irrigation area was expanded to 101,340 ha. Table shows the acreage of land alloted to respective enterprises under the present Dez project.

As it will be clear from the above table, the irrigation area covered by the Dez project is used for two purposes. The aforementioned data of the Ministry of Water and Power states as follows in explanation of the characteristics of the agriculture.

"The greater part of the irrigation area is alloted to integrated and commercial agricultural enterprises, while the remaining land is utilized by farm corporations organized by local farmers under the directing of the Ministry of Land Reform and Rural Affairs. The farm corporations are given operation, management and other assistances from the commercial agricultural enterprises."

The said data does not explain why agri-business was introduced in Khuzistan area but simply gives the following explanation.

"The success of the experiments conducted at Haft-Tapeh and the excellent results obtained at Safiabad Experiment Station located within the Dez Pilot Irrigation Project Area opened up the way for the Iranian government to turn the Dez Irrigation Project Area into a large-scale and integrated commercial farm."

The above explanation was supplemented as follows by the Iranian represenatative at the Japan-Iran Investment Meeting held last summer,

"An amount of about 4.5 billion dollars is planned to be invested in the agricultural sector under the Fifth Five Year Plan with the view to raising the annual growth rate of agricultural production to 5.0%. In addition, an amount of of 1.5 billion dollars is earmarked to secure the supply of irrigation water and improvement of irrigation facilities. Despite of such huge capital input in agriculture, it is anticipated that substantially large volumes of agricultural products will have to be imported towards the end of the Fifth Five Year Plan. It is for this reason that the Iranian government is planning to develop about 300,000 ha of new farmland through introduction of agri-business in parallel with the improvement of the existing farmland area of 400,000 - 500,000 ha."

The representative thus clarified the outline of agri-business and its future development, and stated as follows about the objective of agri-business.

"Agri-business was introduced as a provisional measure the long time required for improvement of the existing Iranian agriculture renders it impossible to attain self-sufficiency in food which is a pressing need of today. Agri-business is intended for production and post-production activities in farmland area where large-scale pre-production works were carried out with the government investment."

From this explanation, it can be said that agri-business is a provisional measure adopted by the government in an attemp to recover the huge capital invested under the past economic development plans. The agri-business

introduced in Khuzistan area serves as a means to reivew the policy of the Iranian government for improving agricultural structure. Further, considering the fact that the Iranian government requested Japan's investment in the agri-business at the Iran-Japan Investment Meeting, it appears justifiable to make a detailed study on the Iranian agri-business to cast light on the agricultural policy enforced in developing countries.

During its visit to Safiabad Experiment Station on December 10, the mission was informed that the agri-business enterprises are bound by the following conditions.

i) Construction of roads and canals to the district's border is undertaken by the government, whereas the infrastructural investiment within the district is left to respective enterprises.

ii) The lease of land is 30 yeas but can be extended upon its expriration.

iii) The contracting enterprise is obliged to cultivate two-thirds of the land leased in three years after conclusion of the contract.

iv) The land is leased by the government, and the shares of the contracting enterprise are to be held equally by the Iranian government and the government of a third country.

v) The rent of land is Rls 1,500/ha for the first three years. In the fourth and subsequent years, however, two-thirds of the net profit is to be paid by the enterprise as rent.

vi) Water charge is Rls 0.2 per m^3.

Reference Data:
1. "Agribusiness Potentials in Iran" compiled by the Industrial and Trade Research Centre, Ministry of Economy, Iranian Government.
2. Report of the Agricultural Sub-committee, Japan-Iran Investment Commission.
3. "Irrigation and Drainage in the World" compiled by the International Irrigation and Drainage Commission of Iran.

Summary of Land Allocations - Dez Irrigation Project

Khuzestan Water and Power Authority Headquatus Area	700 ha
H.N. Agro-Industry of Iran and America	20,580
Iran-California Company	9,560
Iran Shell Cott Co.	14,990
Ahwaz Sugar Refining Project	8,930
Dez Kar Company	4,530
Ohen for Agribusiness	13,540
Safiabad Trial Torm	200
Resettlement Centres (improvement of existing agriculture)	11,620
Total	84,650

Note: The area alloted to Haft Topeh Sugar Project is not included. This table was prepared from the "Agribusijess Potentials" compiled by the Iranian Ministry of Economy.

B. Rasht Pilot Farm

This section deals with the problems in paddy rice cropping brought to ought by the mission's brief visit to Rasht Pilot Farm which was made at the request of Mr. Milheidari, the Iranian Vice-Minister for Agriculture (the mission members who visited the farm were Dr. Seino, Ikeda and Terażawa).

Since the mission was not provided with clear explanation on the objective of the farm during its stay in Iran, the following description presupposes that the farm was established for the purpose of introducing mechanized paddy rice cropping in the coastal area of Caspian Sea.

(1) Need for Infrastructural Improvement

Although drainage is not conducted satisfactorily at present, it can be improved since there is a sufficiently large head between paddy field and drainage canal. The poor drainage condition is assignable to deficient levelling work and the large plot size (each plot covers an area of 0.5 ha). If satisfactory levelling work is conducted and the area of each plot is reduced to about 0.25 by plot rearrangement with suitable care taken of the fields, then the drainage condition will be sufficiently improved.

(2) Breeding

The mission hopes that new and improved varieties will be produced through the breeding efforts currently made at the Rice Research Centre. It is also hoped that local varieties will be improved to early maturing, and high-yielding ones. These three characteristics are the indispensable factors of the planned mechanization of paddy cultivation.

(3) Weeding

Paddy cultivation in the coastal area of Caspian Sea appears to be hampered by weeds, particularly by Echinoeloa crus-galli (called "Soruf" in Persian). This weed is a therophyte belonging to Gramineae. Herbicides applied at a wrong time or by a wrong dosage often display no weeding effect at all if paddy is cultivated by direct seeding method. In case transplanting is conducted, however, weeds can be controlled with relative ease since their growth is suppressed by puddling. Weeding techniques are important and should be improved in parallel with the introduction of mechanized farming.

(4) Improvement of Farming Equipment

The paddy fields which are muddy during the harvesting season reject any attempt to introduce mechanized farming. The drainage condition should therefore be improved, with the width of combine caterpillars also made larger. Transplanters comprise two kinds, one for grown paddy seedlings and the other for young seedlings. Japanese made young seedling transplanters work perfectly, whereas those for grown seedlings have some defect to be corrected. The mission believes that the former, which are intended for transplanting seedlings grown in the nursery bed to a grass height of about 10 cm, are quite suited for paddy cultivation in Iran.

If weeding can be conducted perfectly, the direct seeding method is recommendable in Iran since it dispenses with puddling and consequently makes the soil condition better suited for operation of combines.

(5) Rice Research Centre

The mission recommends that the activities of the Rice Research Centre adjoining Rasht Pilot Farm be diversified and enhanced by reinforcing its staff so that the outcome of its experiments will be put to trial at the pilot farm.

C. Record of Discussions between the Mission Leader and Iranian Authorities

(1) The mission made a courtesy call on H.E. Mr. Mansur Ruhani, Minister for Agriculture, on December 12 and requested to be provided with answers to the following questions.

1) Is the agricultural development of Sistan area intended for economic stabilization of the local farmers or for introduction of the agri-business in progress in Khugestan area?

2) Is there any plan mapped out for processing sugar beet and oil seeds which are included in the crop rotation pattern established under the project? Would the minister agree to the need for establishings processing plant of such crops when their productivity improves? and would he expect activities of private enterprises for processing of such crops?

3) Is the government ready to provide subsidy to terminal infrastructural improvement which is indispensable for the planned production increase?

Answers given by H.E. Mr. Ruhani to the above questions are as follows.

1) Introduction of agri-business in Sistan area will incur nothing but social problems. Hence, farm management in the district is planned to be stabilized by organizing farmers into an agricultural cooperative association.

2) Introduction of private processing plants of sugar beet and oil seeds is quite desriable, though no private enter prises are likely to invest in this line of business. Accordingly, processing will have to left to state processing plants.

3) The government is ready to offer subsidy for terminal infrastructural improvement.

(2) The mission had a discussion with Mr. Milheidari, the Vice-Minister for Agriculture on December after paying a courtesy call on the Minister for Agriculture. Mr. Milheidari, gave the following on Rasht Pilot Farm and the mission promised to visit the farm.
(See Section 4-2 for details)

1) Japanese experts returned home before the farming method was established.

2) Introduction of mechanized paddy cropping gave rise to the following problems.

i) Transplanters were not suited for actual application because they were trial products manufactured in Japan.

ii) Combines are suited for mechanized cropping of Japanese varieties because the harvesting season coincides with the dry season. However, when applied to local Iranian varieties which have a long growing period and are harvested in the wet season, they failed to perform the reaping function because the fields were water logged.

iii) Productivity from privately owned paddy fields is larger than from the pilot farm, which is rather embarassing. Japan's technical cooperation is therefore requested in order to shorten the growing period of local varieties.

(3) The mission reported the findings of the survey in Sistan district to Mr. Milheidari, on December 21.

On the day following its return to Teheran from Sistan district, the mission paid a courtesy call on Mr. Milheidari, and expressed its gratitude for the cooperation extended by him, and summarized the survey result as described below.

Summary of the mission's report:

i) The mission wishes to express its respect for the ambitious plan drawn up for development of Sistan area and trusts that the plan can be brought to a reality.

ii) However, since the farmers in the area still follows traditional extensive farming practices and their technical level is rather low, the mission considers that it would not be an easy task to improve farm management and organize farmers after irrigation water becomes available.

iii) The mission understands that the Iranian government takes into consideration the district's natural condition and plans to augment production of winter crops (e.g., wheat) and summer crops (e.g., cash crops such as sugar beet and oil seeds) and to develop livestock farming. To carry out this plan and bring it to a success, the mission considers it imperative to establish farming techniques and train farmers in such techniques. The farming techniques to be established and extended among farmers should include water management techniques for ensuring most economical and efficient utilization of precious irrigation water.

iv) In carrying terminal infrastructural improvement the salt leaching of alkali soils by means of underdrainage should be conducted under the detailed soil survey. The mission further considers it necessary to study the possibility of shifting from the traditional basin irrigation to furrow irrigation for cultivation of each kind of crops.

v) The mission believes that the best breeding method of domestic animals is to combine the tradtional Hamun grazing with the feeding of forage crops.

vi) With respect to the need for establishing a pilot farm, the mission shares the view of the Iranian government but considers that the farm should perform the following three functions concurrently.

a) Experiments and surveys.
b) Trials of the findings of experiments and surveys.
c) Extension service for actual application of new techniques by farmers.

The mission has the opinion that due consideration should be given to the training of extension workers who will be serving in the project area and to the technical training of young local farmers who will be pushing forward the project.

vii) The present survey was conducted in winter and did not therefore cover the aspect of farm management. To prompt the technical cooperation agreed upon by the two governments, a survey by another mission in the coming summer is considered essential. The mission intends to report to the Japanese government to this effect.

Mr. Milheidari expressed his appreciation of the mission's survey activities and made his views clear as stated below in which he attached the greatest weight to the development of livestock farming.

i) Development of Sistan district calls, above all other things, for experiments and studies intended for establishing an irrigation and drainage system best suited to the district's conditions. As for livestock farming, increased production of sheep, beef cattle and dairy cattle is hoped to be attained through improvement of pasture land and introduction of forage crops. As livestock farming has been the district's most important industry since olden times, top priority will be given to its development with every effort exerted for improvement in both quality and quantity of livestock products and for establishment of rationalized farming pattern. Mr. Milheidari also stated that he hopes that there will be established an integrated distribution channel of livestock products involving slaughtering, processing and transportation of frozen meat.

ii) The pilot farm will be charged with the task of establishing 3 - 4 year rotation patterns. If the rotation of summer crops is established primarily for forage crop cultivation, then sugar beat and oil seeds may also be included in the pattern, though their processing will present a problem if theier planted area is small.

iii) Under the Fifth Five Year Plan, top priority is given to agricultural development with particular stress placed on livestock farming for augmented meat production Mr. Milheidari added that livestock products account for 40% of the country's total agricultural production and the demand for meat is growing at an annual rate of 8%). Consideration is given to the possibility of raising more cattle and reducing the number of sheep through introduction of suitable forage crops, but the demand for beef may not grow rapidly because Iranians have a strong liking for the taste of mutton. (The ratio of cattle to sheep is 7 : 3 at present).

iv) The government established the Sistan Baluchestan Development Agency for development of sistan district. The agency is exerting its efforts for recruting experts and technicians and for improving their living environments including accommodation facilities. The agency is also planning to select capable farmers and train them at the pilot farm.

v) The government is planning to either disburse the total fund required for infrastuctural improvement or cover 40 to 50% of the fund. This government disbursement will be added to the water charge and collected from farmers. If the government is disburse part of the

fund, the remains will be provided to cover the farmers' burden share as the loans. In this case, loans will not be advanced at a lower interest rate. Loans for agricultural development were once offered at a low interest rate, but that resulted in illegal disposition of the fund. At present, therefore, loans are advanced at a same interest rate irrespective of the kind of industry.

The mission leader then made reference to Rasht Pilot Farm (see Section 4-2 for details) and stated that he considered it regrettable that the Rice Research Centre adjoing Rasht Pilot Farm is staffed by only one expert and the two organizations are not cooperating with eath other. He stressed the need for training agricultural experts and attracted the vice-minister's attention to the fact that the situation in Sistan district is quite similar.

At the close of the discussion, Mr. Milheidari expressed his desire for early preparation of the English version of the survey report, with the request that it will cover all such items as establishment of the pilot farm, irrigation, livestock farming, farming techniques and farm management, and further expressed his strong hope for the dispatch of the second survey mission by the Japanese government.