Chapter 6

Feasibility Study of Tazeh Abad Irrigation and Drainage Project

CHAPTER 6

FEASIBILITY STUDY OF TAZEH ABAD IRRIGATION AND DRAINAGE PROJECT

6.1 Existing Conditions of the Project Area

6.1.1 Natural Conditions

(1) Meteorology

1） Climatic Conditions

The Tazeh Abad Scheme is situated at the north-east part of the study area, in the area covered by the Aq Qala meteorological station, according to the division utilized in this study by the Thiessen method. The study area has the following meteorological characteristics.

Meteorological Characteristics of the Aq Qala St. (Average)

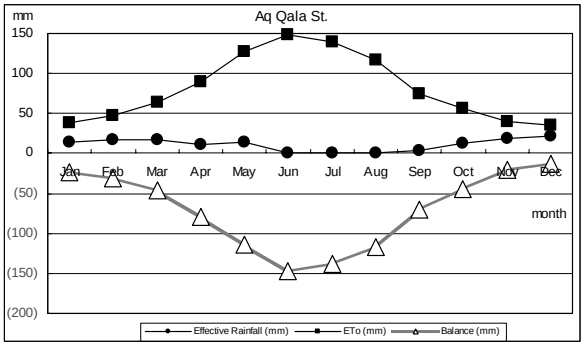
Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rain (mm)	41.2	44.4	46.0	34.2	40.2	12.7	9.4	12.6	22.6	38.0	47.3	52.7	401.3
Temperature (^{o}C)	9.9	15.7	18.3	22.3	27.3	32.0	31.2	27.5	22.4	17.1	12.5	9.2	20.5
Evaporation (mm)	58.7	72.4	97.6	137.9	196.7	227.3	213.6	179.5	114.4	87.6	60.2	53.4	1452.3
Humidity (%)	73.0	76.3	78.7	84.5	84.7	84.5	83.1	79.3	72.9	75.0	73.3	75.0	78.4

2） ETo and Effective Rainfall

The referential evapotranspiration, to be used in the calculation of the necessary irrigation water, was calculated from the measurement data of evaporation (class A tank) as shown below. The value of the constant utilized for the calculation was the one recommended by the FAO with the value of 0.65. The next table shows the ETo and effective rainfall.

ETo and Effective Rainfall (mm)

Station	Jan Bah	Feb Esf	Mar Far	Apr Ord	May Kor	Jun Tir	Jul Mor	Aug Sha	Sep Meh	Oct Aba	Nov Aza	Dec Dey	Annual Sum
ETo (mm)	38.1	47.0	63.5	89.6	127.9	147.8	138.9	116.7	74.4	56.9	39.1	34.7	974.6
Effective Rain (mm)	14.7	16.6	17.6	10.5	14.1	0.0	0.0	0.0	3.6	12.8	18.4	21.6	129.9



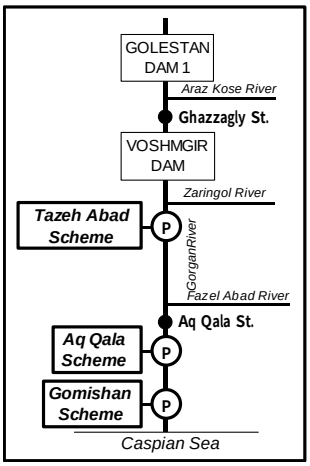
The effective rainfall, also for the calculation of the irrigation necessity, was calculated by the empirical formula of AGLW/FAO. The comparison of the effective rainfall and evapotranspiration data registered at the Aq Qala St. is that the evapotranspiration exceeds the rainfall showing a negative balance during all the

year. This region is the most dry area in the Study Area.

(2) Hydrology

1） Surface Water

The Tazeh-Abad I&D Scheme is located just downstream of the Zaringol river. It means that the water available for this area comes from the Voshmgir dam and Zaringol river. The right figure shows a schematic view.



So, the water availability for the target area shall be as follow:

Estimated Available Discharge

(MCM)

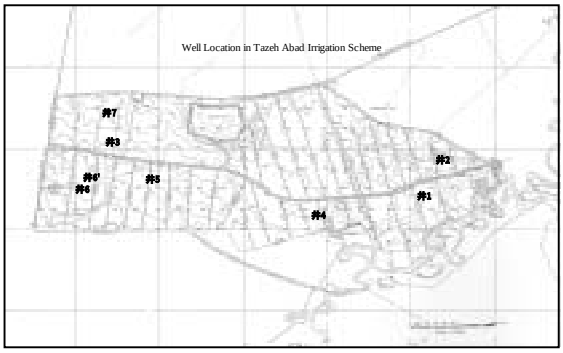
Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Voshmgir Dam	0.8	0.6	0.4	0.4	0.7	2.2	6.0	5.8	3.6	6.4	5.1	2.0	34.0
Zaringol River	0.2	2.3	2.1	4.4	6.8	7.6	5.7	8.2	0.4	0.0	0.0	1.0	38.8
Available Water	1.07	2.87	2.48	4.81	7.50	9.81	11.71	13.98	4.06	6.38	5.13	2.97	11.6

2） Groundwater

There are only 8 wells constructed and used for irrigation in the scheme area. The characteristics of the well are as follows:

Wells in Tazeh Abad Area

No	Construction Year	Discharge (lit/s)	Irrigated Area (ha)
1	2002	5	27
2	2000	5	19
3	2001	5	14
4	2001	5	21
5	1974	2	11
6	1991	5	65
7	1989	3	
8	1975	2	10



(3) Soils

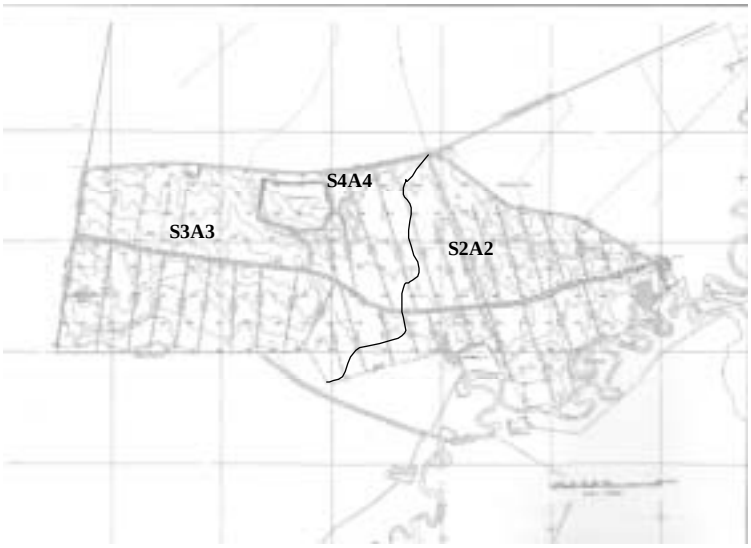
The present conditions of the Soils in the Tazeh Abad Project Area were analyzed using the data and information collected through the following soil surveys:

1. Soil Survey by the Golestan Agriculture Organization

2. Soil Survey by the Soil and Water Research Institute

3. Soil Survey by the JICA Study Team

The results of soil analysis carried out in September 2002 are shown in Table 6.1.1. The salinity and alkalinity contours drawn based on Soil Survey by the Soil and Water Research Institute[1] is shown in the figure .The soil characteristics analyzed based on the above three soil surveys are summarized as follows:



Semi-detailed Soil Survey in Tazeh Abad Project Area (1989)

In Tazeh Abad project area, pH of the soils is in the range of 7.5 to 8.1. In general, the salinity of the Project Area is in a severe (S3) level in the western part of the Project area, where as the eastern part of the Project Area has salinity in the moderate level (S2). Only some areas, which are close to the Gorgan river and has been irrigating has the salinity is in a lower (S1) level because of regular irrigation and drainage. Sodim Adsorprtion Ratio (SAR) varies from a low level of 9.1(A1) to a severe level of 48.4 (A3). The alkalinity level is also higher in the western part of the compared to eastern part of the Study Area. Both EC and SAR values increase at the bottom layers of the soils.

In regard to the fertility status of the soil, the CEC values indicate that the soils have a low (CEC<15) to moderate fertility (CEC<25). In the top layer of 0-30 cm, the levels of Nitrogen and Phosphorus are in the low to moderate level where as the level of K is normally in the higher level.

[1] Reference : Ahmad Mossavati, and Mohd. Yousef Naseri, Soil studies and semi-detailed land classification of Habibishan Dam Region of Gorgan-Mazandaran Province, 1989.

Table 6.1.1 Results of Soil Analysis in Tazeh-Abad Project Area (Sep 2002)

Sample No.	Depth (cm)	pH	EC (mS/cm)	SAR	Sal / Alkali Classi-fication	CEC (me/100g)	$CaCO_3$ (%)	O.C (%)	Total N (%)	P (Ava) ppm	K (Ava) ppm	Cations (meq/l)			Clay (%)	Silt (%)	Sand (%)	Classification
												Na^{+}	$Mg^{++} + Ca^{++}$	Sum Cations				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
L1-1	0-30	7.7	7.2	9.1	S1A1	18.0	15.5	1.26	0.13	8.5	320	50.0	60.0	110.0	20	72	8	Si-L
L1-2	30-60	7.6	7.9	10.6	S1A1	17.0	20.5	0.48	0.05	3.5	180	60.0	64.0	124.0	6	90	4	Si
L1-3	60-90	7.6	9.3	14.4	S2A2	16.0	15.0	0.43	0.04	3.5	176	80.0	62.0	142.0	-	-	-	Flocculate
L2-1	0-30	7.9	29.1	43.0	S3A3	12.0	15.5	0.37	0.04	4.5	260	325.0	114.0	436.0	10	66	24	Si-L
L2-2	30-60	7.9	28.1	42.9	S3A3	10.0	17.0	0.24	0.02	3.5	136	315.0	108.0	423.0	16	70	14	Si-L
L2-3	60-90	8.0	31.2	48.4	S3A3	9.0	17.0	0.22	0.02	4.0	116	375.0	120.0	495.0	10	66	24	Si-L
L3-1	0-30	7.6	13.0	16.4	S2A2	18.0	13.0	1.18	0.12	5.5	290	104.0	80.0	184.0	-	-	-	Flocculate
L3-2	30-60	7.5	16.9	21.4	S2A2	14.0	18.5	0.30	0.03	5.0	130	150.0	98.0	248.0	6	78	16	Si-L
L3-3	60-90	7.5	20.1	21.3	S3A2	10.0	17.0	0.18	0.02	3.7	60	164.0	118.0	282.0	-	-	-	Flocculate
L4-1	0-30	7.9	8.2	22.2	S2A2	19.0	18.2	0.56	0.06	6.5	290	80.0	26.0	106.0	6	84	10	Si
L4-2	30-60	7.7	16.5	30.5	S3A3	19.0	22.0	0.37	0.04	4.7	176	170.0	62.0	232.0	-	-	-	Flocculate
L4-3	60-90	7.8	24.3	42.4	S3A3	12.0	18.0	0.21	0.02	3.2	100	275.0	84.0	359.0	-	-	-	Flocculate
L5-1	0-30	7.9	22.7	36.9	S3A3	12.0	16.5	0.85	0.09	6.7	380	250.0	92.0	342.0	-	-	-	Flocculate
L5-2	30-60	8.0	32.6	43.3	S3A3	7.0	19.5	0.14	0.01	4.5	140	360.0	138.0	498.0	-	-	-	Flocculate
L5-3	60-90	8.1	17.5	30.4	S3A3	6.0	19.5	0.13	0.01	4.2	80	180	70.0	250.0	-	-	-	Flocculate
L6-1	0-30	7.9	15.2	21.3	S2A2	16.0	15.5	0.82	0.08	11.2	400	140.0	86.0	226.0	8	84	8	Si
L6-2	30-60	7.9	17.1	25.4	S3A2	12.0	18.5	0.42	0.04	4.7	220	174.0	94.0	268.0	-	-	-	Flocculate
L6-3	60-90	7.9	16.2	24.2	S2A2	12.0	19.5	0.22	0.02	5.7	150	164.0	92.0	256.0	-	-	-	Flocculate

Texture of the soil is mostly medium textured silt-loam (silt > 60% and clay <30%). However there are also heavy textured silty clay loam (silt >55% and clay >25%) and very heavy textured silty clay (silt >50% and clay >30%) soils at some locations of the Project area.

Comparing the soil analysis data of 2001 with that of 1989, it was found that the salinity and alkalinity levels of the Project area have not been changed significantly. The irrigation was carried out mainly in the eastern part of the Project Area only for once in 2001 and the amount of water applied was not sufficient enough for drainage. Although the salinity level decreases immediately after the irrigation, the drained salts move upwards to the root zone by capillary rise because of insufficient drainage. The effect of the drainage system can be verified only after applying enough amount of irrigation and drainage water.

(4) Environment

1) Existing Environmental Conditions and Problems of Tazeh Abad Project Area

There are Voshmigr dam, wetlands and fish breeding farms near and around the Tazeh Abad Project Area and these conditions make the locations a proper place for migratory birds to spend winter. *Incheh* lake with saline water is located at 12 km north of Tazeh Abad and living *Artemia solina* is a food source for some birds such as flamingo.

The major environmental problems in the project area are as follows:

- High salinity and alkalinity of the soils of the Project Area
- High level of underground water
- Water quality of Gorgan River

The salinity, alkalinity of the soils varies from S1A1 to S3A3 and S4A4 in some small areas. Except for a small area in the southeastern part of the Project Area, most of the soils have a higher salinity and alkalinity level. The combination of low amount and poor quality of irrigation water for leaching, and insufficient drainage system increase the salinization and alkalinization of the soil.

According to the soil survey and land classification study carried out by the Soil and Water Research Institute, the groundwater is mostly at a depth of 1-2m in most part of the Project area. Because of the higher level of the groundwater table, the salts in the drained water moves down to the groundwater and again rise back to the top of the soil by capillary rise. It is necessary to reduce the groundwater table in the Project Area with sufficient drainage system.

Water quality of Gorgan river which supplies irrigation water for the project area is the major environmental concern of the project area. According to USDA classification, the water of Gorgan river is in the range of C3S1 to C4S2, and the salinity of water is in the higher level.

This condition was noted both during the first and the second field surveys. Therefore, the irrigation water may cause serious salinity problems, if the soils are not properly drained. For salinity control, excess water application for leaching is necessary. However, the Sodium Adsorption Ratio (SAR) is at a slight (S1) to medium level (S2).

The water quality in the winter season is much better than that of the summer season. During summer season, there is high amount of drainage water flow into the Gorgan river and the river water is mostly the drainage water from the fields and therefore the salinity of water is very high, since the soils also have high salinity and alkalinity.

Sedimentation is another major problem of the Gorgan river. Since there are few tree covers in the upstream side hilly areas, the water drained from these areas brings along a heavy volume of sediments, which are flown into Gorgan river. During the first field survey in Jan 2002, sedimentation problem was observed in the Gorgan river and the total suspended solids (TSS) at the upstream and middle stream was about 1110 and 780 mg/l. Normally, a TSS level of less than 100 mg/l is suitable for irrigation and at a higher level, they normally block the canals, disturb pumps and irrigation systems and cause sedimentation problem at the dams.

The water quality survey by environmental research center also shows that the sedimentation from October to March is at a much higher level in the range of above 7,000 mg/l. Annual sedimentation at Vosmgir dam is estimated as 1.3 MCM/year and at the Golestan dam it is estimated as 0.6 MCM/year.

2) Environmental Monitoring and Management System (EMMS)

An environmental monitoring and management system shall be established to monitor the project's environmental impacts on the project area and the surrounding areas, aiming at adequately protecting the environment both during and after the project implementation. The monitoring and management measures corresponding to potential adverse impacts mentioned above are listed below.

1. Regular monitoring of water quality in Gorgan river and appropriate use of fertilizers and agriculture chemicals
2. Regular monitoring of water quality in Gorgan river and regular cleaning of desilting pond in the Project Area
3. Regular monitoring of soil properties and proper recommendation of fertilizers and chemicals
4. Inclusion of proper drainage system and adaptation of salinity resistant varieties
5. Proper distribution and usage of surface water and use of water saving methods
6. Regular monitoring of groundwater and use of water saving methods
7. Regular monitoring of atmospheric pollution and adoption of proper farm management practices

Golestan Provincial Directorate of Environment and Golestan Province Agriculture Organization shall coordinate together in establishing EMMS for the province.

3) Results of Initial Environmental Examination (IEE)

As per the regulations of Iran, EIA needs to be executed for the following projects related to irrigation and drainage and agriculture development.

- New irrigation/drainage project, which exceeds the size of 5000 ha or more.
- Dam of more than 15m high with area more than 400 ha area
- Man-made lake with area more than 400 ha area

In Tazeh Abad project area, a storage pond is under construction. However, the storage pond, which is constructed is smaller than the size of 400 ha. Therefore EIA is not necessary for constructing this pond. In regard to irrigation and drainage works, construction of irrigation and drainage canals are not fully completed and are planned to be completed in the near future based on the budget availability. It is also hoped to improve the drainage system in the project areas based on the necessity and the budget availability. Since these works are only a part of on-going works, there is no need to carry out EIA.

6.1.2 Socioeconomic Conditions

(1) Population

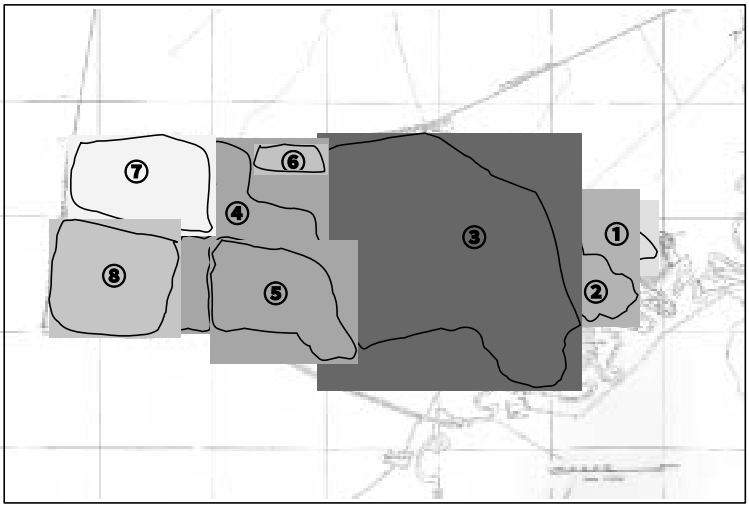
Tazeh Abad Project Area has one RPC (Rural Production Cooperative) named RPC Pavand. The RPC Pavand includes 451 members, mainly consisting of Turkmen and Baluchi, living in 7 Dehs (Chen Sbli, Tazeh Abad, Adakesh, Aq Zebir, Granjik, Seydlar, and Salagh Yolghi) and in the near future 8 Dehs (adding Saghar Yolghi), which are in or near the project area. Number of RPC members, households, and population by Deh are summarized in the table shown below.

Number of RPC Members, Households, and Population by Deh

No.	Name of Deh/ Group	Covered area by RPC Pavand (ha)	Number of Members (person)	Household	Population (person)
1	Chen Sbli	250	45	658	3,325
2	Tazeh Abad	320	51	63	332
3	Adakesh	1,100	107	186	1,020
4	Aq Zebir	350	60	145	871
5	Garanjik	440	64	161	1,039
6	Seydlar	40*	61**	51	321
7	Salagh Yolghi	550	63 (+ 14, expected)	218	1,304
8	Saghar Yolghi	(450)	(56, expected)	165	1,004

Source: Hearing from RPC Pavand President (Oct. 2002)
Note: *The area for the construction of the reservoir
**They pay Rls.50,000/ha as a members' fee but the RPC borrows their land for the reservoir and pays 220kg/ha x the wheat price guaranteed by the government.

The location of each group's farmland is shown below.



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①	Chen Sbli
②	Tazeh-Abad
③	Adakesh
④	Aq Zebir
⑤	Garanjik
⑥	Seydlar
⑦	Salagh Yolghi
⑧	Saghar Yolghi

(2) Economic Activities

The main economic activities of the members of RPC Pavand are agriculture and animal husbandry. Besides farmland, they own at least one or two milk cows, sheep or camels. Besides, all of the members have a side job.

(3) Marketing

1) Marketing Channel of Agricultural Products from Tazeh Abad Project Area

The marketing channel of agricultural products from Tazeh Abad Project Area is differentiated by product from the other areas. Cultivation area and main buyers by product are described in the table below.

Cultivated Area and Main Buyers of Agricultural Products in Tazeh-Abad Project Area

Agricultural Product	Cultivated Area (ha)	Main buyer
Wheat	1,200	- RCO (Rural Cooperative Organization) - Cereal Organization (Public enterprise) - Flour milling factories (State-owned/ Private) - Middlemen
Barley	1,365	- Animal Husbandry Organization - Cereal Organization
Rape seed	150	- Oilseed Product Development Company (semi-governmental) - 2 private companies in Aq Qala City (for selling to oil processing factories)
Cotton	53	- Cotton factories (Private) - Middlemen
Rice	40	- RCO (specific varieties) - Middlemen - Consumers
Cumin	2	- Middlemen - RCO

Agricultural Product	Cultivated Area (ha)	Main buyer
Maize	40	- Animal Husbandry Organization - Animal Husbandry Association
Sun flower	60	- For oil: Oil Seed Production Development Company - For snacks: middlemen
Broad bean	4	- Middlemen - Wholesale market - Selling by themselves
Sorghum	20	- Animal Husbandry Organization
Milk	- (415 heads)	- Milk processing factories through middlemen in the Dehs - Peddling in the Dehs

Source: Hearing from RPCs President (Oct., 2002)

Tazeh Abad Project Area is located 25km from the place in Aq Qala City for One Day *Bazar* (Market) opened every Thursday and 45km from Gorgan City vegetable and fruits wholesale market. The nearest Cereal Organization is located in Anbar Olum City 5-6km from the project area. Branches of Animal Husbandry Organization, which is a subordinate organization to Ministry of Jihad-e-Agriculture, are located in Gorgan, Aq Qala, Bandar-e-Torkman, and Kordkuy Cities and the members can choose where they deliver their forage products.

2) Marketing Problems of Agricultural Products in Tazeh Abad Project Area

a) Price of the products: The main problem of the price exists in barley. The price presented by the middlemen is lower than the governmental guaranteed price. But farmers have to sell barley to middlemen when they face shortage of money.
b) Relationship with the buyers: In case of wheat, a main buyer is Wheat Collection Center of RCO. They feel that RCO tries to set the low price as much as possible. Delayed payment for rapeseed, rice and cotton are also recognized as a problem.
c) Market information: Information on market such as governmental guaranteed prices is broadcasted through radio and TV programs, and also expanded through the RPC. But some of the members do not care much about the condition of market and they produce based on their capacity.
d) Transportation means and cost: Usually, farmers transport their products by themselves by borrowing trucks from a truck syndicate. Rental changes by demand and it is Rls.20~40/kg although it is officially fixed. RCO, Cereal Organization, flour milling factories, Animal Husbandry Organization, and cotton factories pay for transportation cost based on the sales' volume. For example, Wheat Collection Center of RCO pays Rls.30/kg (2002). Deh level RCO does not pay for transportation cost because it is usually located very close to farmland. The transportation cost becomes higher than that they are provided when the production is smaller than 10t and the members have to wait in a line for all day long or more because they have to pay additional rental, Rls.10/kg, to

the truck syndicate. Therefore, they want RCO to open 24 hours during the harvest season.

3) Agro-processing industry

Right now, there is no agro-processing factory in and around Tazeh Abad Project Area. Nevertheless, there are potentials to introduce agro-processing industry around this area. This is because a) The members of the RPC have keen interest in providing materials to agro-processing factories, and b) there is no problem to gather workers since the area have problems with unemployment of youth and women.

(4) Agrarian Society

The difference of the administrative structure of Deh is not so noticeable according to race although it remarkably appears in their customs and activities, especially of rural women. The representatives of Dehs are the members of rural council, elders, and mullahs. The society consists of landed farmers, tenant farmers, agricultural labors, animal breeders and public servants, small storekeeper and *ab-ban mirab* (a traditional water manager). Population of the 8 Dehs mainly consists of Turkmen and Baluchi.

(5) Rural Production Cooperatives (RPC Pavand)

1) General

General information of RPC Pavand is shown in the following table.

General Information of RPC Pavand

Prefecture	Year	No. of Deh	Covered land area (ha) (irrigation)	Membership (persons) (M:F)	Main Race	Average holding area (ha) (Mini/ Max)
Aq Qala	1997	7 (8)	3,500 (2,000)	451 (446:5)	Turkmen , Baluchi	8 (2/ 100)

Source: Hearing from the RPC Pavand (Oct, 2002)

The eligible persons to be a member of RPC are those who hold farmland in the covered area (Dehs) by RPC. The entrance fee is Rls.50,000/ha in case of both rain-fed and irrigated farmland in case of RPC Pavand. Additionally, the members have to pay annual member's fee and water charge if they receive water from the irrigation network.

2) Organizational structure

RPC Pavand comprises of a RPC President and an accountant dispatched from Jihad-e-Agricultural Organization, and an agronomist, a tractor operator, a guardsman hired by the RPC and an executive board selected among the members. The executive board comprises of 5 persons: President, Vice President, Secretary and two non-positioned persons

selected by the election among all of the members every 3-year. Moreover, there are 2 inspectors, who supervise the management of the RPC 3-4 times a year. They are also selected at that time. Their term of service is 1 year.

3) Activities and decided matters of the RPC

The activities of RPC Pavand are 1) construction of agricultural infrastructure, 2) water distribution, 3) leveling, 4) selling agricultural inputs (seeds and agricultural chemicals subsidized by government), 5) lending and selling agricultural machinery, 6) collecting and shipping of agricultural products and 6) providing agricultural extension service. Besides these activities, the RPC donates to school in the covered Dehs.

The matters decided in the RPC are 1) the rules that the members must comply with, 2) buyers of 4 tractors that RPC bought with low interest rate, 3) water distribution (*ab-ban mirab* distributes water following the RPC decision), and 4) value and time of donations to school and so on following the basic policy of Golestan Jihad-e-Agricultural Organization.

4) Available finance for RPC and RPCs' members

Available finance for the RPC is as same as the other RPCs. When RPCs carry out their activities such as installation of agricultural infrastructure, it can obtain the credit from Agricultural Bank in the conditions different from individual farmers.

5) Benefit and debt

The benefit and debt of RPC Pavand in 2001 are shown in the following table.

Benefit and Debt of RPC Pavand (2001)

Benefit (Rls.)	Debt (Rls.)	Repayment/year (Rls.)	Purpose of Debt
400 million	2.1 billion	110 million	- Install of irrigation and drainage canals - Purchasing agricultural machinery - Purchasing agricultural inputs

Source: Hearing from the RPC Pavand (Oct., 2002)

Current balance of RPC Pavand has been surplus so far. Therefore, the RPC can afford to employ its President and other staff by itself, after RPC President, who dispatched from Jihad-e-Agricultural Organization, completes his term.

6) Strengths/ opportunities and weakness/ threats (problems)

Strengths/ opportunities and weakness/ threats (problems) of RPC Pavand, which the RPC points out, are described in the table shown below.

Strengths/ Opportunities and Weakness/ Threats (problems) of RPC Pavand

Strengths/ Opportunities	Weakness/Threats (Problems)
l) RPC can expand irrigation area (if affordable) 2) RPC can contribute to increasing farmers' production through extension service. 3) RPC can provide agricultural inputs surely at the fixed price. 4) RPC contributes to increase of mechanization. 5) RPC puts the first priority on farmers and agricultural development. 6) RPC can protect the members' landholding right.	l) Shortage of water 2) RPC has to borrow money from Agricultural Bank because of not having machinery and equipment for installing canals and leveling lands. 3) It is hard to achieve farmers' trust. 4) Some of the elder members hesitate to introduce new crops. 5) It takes time to expand new crop cultivation because of many elder and low educated members. 6) Turkmen has some religious restriction such as not mixing the soil of his own land with the others.

Source: Hearing from the RPC Pavand (June and Oct., 2002)

7) The problems of the RPC's members

The problems of the RPC's members can be summarized as follows.

a) Shortage of agricultural inputs (fertilizer, seeds and agricultural chemicals)
b) High rental of agricultural machinery
c) Insufficient Technical instruction (extension)
d) Shortage of irrigation water distribution and necessity to pay water fee even for locations where the irrigation net work is not completed.
e) Poor farm economy

8) Request to RPC Pavand from the members

The members request for the following to the RPC.

a) Supplying of sufficient water and individual technical extension,
b) Decrease of water charge and additional member's fee,
c) Completion of concrete lining of the irrigation canals,
d) Purchasing tracks for transporting their product, and
e) Selling of wheat seeds as the other years.

(6) Agricultural Assistance and Finance

1) Agricultural Assistance

Among the members of RPC Pavand, 50-60% of them get Agricultural Product Insurance through the RPC. More precisely, all of the members who cultivate rapeseed and cotton get it because of high risk of their cultivation. Cotton is spring crop and there is high risk of inundation. Rapeseed is usually cultivated on a contract with Oilseed Production Development Company. So as to make contract with it, the farmers have an obligation to get this insurance. The ratio of those who get the insurance in the members who cultivate wheat is about 30-40%. Furthermore, in case of the loan from Agricultural Bank, the members can exempt from the payment of the loan interest and the loan is rescheduled when they are damaged from natural disaster.

2) Agricultural Finance

Preparation of production cost for the next year is a very critical matter for all of the farmers. In case of the members of RPC Pavand, they mainly use Agricultural Bank through the intermediation of the RPC or by themselves. The members can borrow money within the limit of Rls. one million through the intermediation of the RPC between Agricultural Bank and them but it is not enough. The production costs are at least: Rls.500,000/ha, Rls.150,000/ha, and Rls.300,000/ha in case of wheat, rape seed and barley respectively. Nevertheless, the RPC provides the loan not based on the area of landholding but evenly. Moreover, sometimes the members cannot borrow money when it is needed for the limit of allocated budget. In this case, the person who has more necessity and is more reliable can get priority to obtain the loan. Obtaining loans from banks (including Agricultural Bank) not through the RPC is difficult if he has no connection with the bank. Asking the loan from their friends is a rare case.

(7) Social Infrastructure

1) Roads and Transportation

a) Access Road to the Project Area

Tazeh Abad Project Area is located at about 20km northeast of Aq Qala City and 50km northeast of Goragan City via Aq Qala City. There are 4 access roads to Tazeh Abad Project Area to Aq Qala City. There is an access road from Aq Qla City to Goragn City and its length is 15-20km. This road is wide, well paved and maintained.

b) Rural Road

Total length of rural road is 100-150km in Tazeh Abad Project Area. The road is unpaved and so it is hard to pass during rain.

c) Public Transportation

Mini bus is the main public transportation mean from the Dehs in and around Tazeh Abad Project Area to Aq Qala City. People change mini bus at Aq Qala City to go to other neighboring cities such as Gorgan.

2) Electricity, Water Supply, Gas and Communication (Telephone Line)

A power transmission line is installed in Tazeh Abad Project Area and hence 100% of the members can use electricity for agricultural production and domestic life. Water supply facilities are not installed only in Deh Tazeh Abad among the other 8 Dehs in the project area. Gas pipeline is not installed yet in this area. As for communication tool, telephone line is not installed in Dehs Tazeh Abad, Adakesh, and Aq Zebir.

3) Education

There are 11 public primary schools, and all of the Dehs, where the members of RPC Pavand live, have at least 1 primary school. There are also 8 public lower secondary schools and 2 public upper secondary schools in the area. School attendance ratio decreases as the level goes up but many students go to lower and upper secondary school in cities or Dehs within a 15km radius from their Dehs. Besides these public schools, there is a private religious school for being mullah in Deh Adakesh. Moreover, a few people go to universities across the nation.

4) Health and Medical Care

Four out of eight Dehs, Adakesh, Chen Sbli, Salagh Yolghi, and Saghar Yolghi, have a public health center for expanding a family planning, vaccinating children, taking care of pregnant women, giving instruction on purification of drinking water, and garbage collection. There is no public clinic but a doctor visits these health centers one a week from Aq Qala City.

6.1.3 Agricultural Conditions

(1) Agricultural Production

The gross cultivable area is 3,210 ha, and the irrigated area in winter and summer are 2,000 ha in 2001 and only 1,200 ha in 2002 because of water shortage for irrigation. The number of farm households by farming scale in the project area is shown in the following Table. The number of households is 102 (28% of total households) in 0 to 3 ha of farming scale, 86 (24%) in 3 to 5 ha, 122 (33%) in 5 to 10 ha, 36 (10%) in 10 to 20 ha, 16 (4%) in 20 to 50 ha scale and 5 (1%) in over 50 ha scale, respectively.

Number of Farm Households by Farm Scale in Tazeh Abad (2002)

Farm scale	Number of farm households
0 ~ 3 ha	102
3 ~ 5 ha	86
5 ~ 10 ha	122
10 ~ 20 ha	36
20 ~ 50 ha	16
> 50 ha	5
Sum	367

In regard to dispersion of a farmer’s owned fields, the number of farmers by number of dispersing fields is 2 farmers, who each has fields of average 25.4 ha in 6 locations, 3 farmers of average 23.6 ha in each in 4 locations, 12 farmers of average 21 ha in 3 locations, 34 farmers of average 8.3 ha in 2 locations, respectively. There is no dispersion of owned land in the rest of 316 farmers, which are 86% of total number of farmers in the project area, as

shown in Table. As the dispersion of farmer's owned field is found in the farmers of relatively larger farming scale, it is seemed that the influence on mechanization is low.

Number of Farm Households by Dispersion of Farmers' owned Fields in Tazeh Abad, 2002

Number of dispersing fields	Number of farm households	Average of owned land
6 locations	2	25.4
4 locations	3	23.6
3 locations	12	21.0
2 locations	34	8.3
1 location	316	7.1
Sum	367	6.9

The number of field plots by plot size class in Tazeh Abad is shown in the following Table. The percentage of farm plot size is 29% in 1 to 3 ha of farm size, 36% in 3to 6 ha, 22% in 6 to 10 ha, 87% in total of these 3 classes, respectively.

Number of Field Plots by Plot Size in Tazeh Abad

Farm plot size	Number of field plot		Area of each plot scale	
	Number	%	ha	%
< 1.0 ha	13	3	6.1	0.1
1 ~ 3 ha	134	29	320.7	10
3 ~ 6 ha	166	36	690.0	21
6 ~ 10 ha	102	22	826.2	26
10 ~ 15 ha	20	4	236.8	7
15 ~ 20 ha	7	2	120.6	4
20 ~ 30 ha	8	2	199.9	6
30 ~ 50 ha	9	2	322.5	10
> 50 ha	6	1	487.2	15
Total	465	100	3,210.1	100

The area and yield per ha of cultivated crops in 2001 were 1,200 ha and 1.5 to 4.5 tons in wheat, 800 ha and 1 to 4 tons in barley, 70 to 80 ha in rape, 60 to 70 ha and 0.5 to 2 tons in cotton, about 100 ha and 3 to 4.5 tons of paddy rice by irrigation with well water, 10 ha of cumin, 40 ha of maize as fodder crop, 60 ha of sunflower, 20 ha of sorghum, etc.

(2) Farm Management

In general, wheat is seeded in December and harvested in May, and irrigated with water of Gorgan River in 2 times of February and the end of March. Barley is irrigated one time in February. After fallow in winter, cotton is irrigated in the middle of March as pre-irrigation to leach salt, and seeded in April, harvested in the end of November, and irrigated 3 times of June, July and August.

A farm households' survey of 7 farmers in the project area was made in July 2002. In the farm households' survey, farm works of 8 items, that is fertilization of organic manure, chemical fertilization and lime, use of certified seed, irrigation, use of herbicide, insecticide, and fungicide, was examined in order to know the level of farmers' cultivation technology. These farmers were seemed irrigation and fertilization of chemical fertilizer at least. The yields of wheat of these farmers were ranged from 1 to 3 tons per ha. Irrigation was carried out in February to May. From these facts, the farmers did not carry out pre-irrigation, fertilization of sulfur to prevent alkalization of soil, fertilization of micro-elements, which are required in soil of Tazeh Abad to attain high yield of every crop.

(3) Animal husbandry

The accurate number of livestock in the project area, such as cattle, sheep, camel, etc., can not be clarified. According to the leader of the RPC, 50% of the farmers in the project area raise 2 to 10 heads of cows, and 10% of the farmers raise 20 to several hundred heads of sheep.

According to the surveyed dairy farmer in Tazeh Abad Deh, who have milking cows of 4 heads, one bull and calves of 2 heads and fattening cattle of 3 heads, and cultivate wheat of 5 ha and barley of 3 ha, stock-farming is carried out as follows;

1) Breed of cow is local breed. Hybrid with Holstein is higher in milk yield than local breed, but it requires cow shed to manage more hygienically, and medical examination by veterinarians several times a year.

2) Cow is mated in late spring, farrows in March, and milks during 5 to 6 months.

3) Quantity of milking is 5 to 7kg/head/day in spring, and 3 to 4 kg in the end of milking (September), and is estimated as 0.8 tons/head/year in milking period of 165 day a year.

4) There is no stall, and cattle are turned out in the daytime and are tied in night.

5) Milking and feeding are carried out by hands 2 times of morning and evening a day.

6) Roughage is straw of wheat (straw hay), which is produced in the owned field and purchased with 500 Rls. /kg from the neighboring farmers in the time of harvest. These hay is stored in shed.

7) Concentrate supplies to only cows. 95% of wheat as concentrate is purchased. All cultivated barley is used as concentrate.

8) Milk is sold to brokers with 1,000 Rls. /kg. Calves and fattening cattle are also sold to brokers. The price of three-years fattening cattle is 2.5 million Rls. in black one and 4 million Rls. in white one.

9） Each percentage by income sources in total annual gross incomes is 50% by crop production, 40% by livestock raising and 10% by farm works with owned farm machines.

As mentioned above, the livestock farming in the project area is usually carried out with traditional methods.

(4) Farm Economy

According to the farm households' survey of 7 farmers in project area, the farm scale of the surveyed farmers were ranged 4 to 65 ha, and 4 farmers raised livestock. The compositions of animal husbandry in total annual gross income in the households were ranged from 10 to 25%. Besides, the compositions of non-agricultural incomes were ranged from 12 to 51%. In production of agriculture and animal husbandry, all farm economies of farmers were in black. However, the annual farm household expenditures were ranged from about 10 to 24 million Rls., and therefore, 4 households were in red in farm household economy.

At present, the project area is suffered by serious shortage of irrigation water and by drought. As farmers cannot count on crop production, it seems to expect on animal husbandry. All of the farmers intend to introduce milk cows of 2 to 20 heads.

With regard to debt conditions of the surveyed farmers in Tazeh Abad, 5 among the 7 households have debt from banks and RPC. Amount of debts are ranged from 1 to 13 million Rls. Repayment conditions of bank's credits are in normal in all farm households, however, repayment conditions of RPC loan are in legal instance in 2 farmers.

(5) Agricultural Extension

At present, agricultural extension for farmers in the Peivand RPC is mainly carried out by the Anbar Olum Extension Service Center through the management of the Peivand RPC. To manage the extension activities, there are two staffs of the RPC, of which one is the leader (agronomist, Province Government employee) of RPC and another is agronomist. The two agronomists of RPC communicate the training courses planned by the Extension Service Center, make schedules of training courses of each Deh, invite farmers to participate, and arrange the place of training.

The actual extension activities in the RPC are as follows;

1） The plan of training courses is presented by the Extension Service Center in every 3 months. RPC communicates to the Extension Service Center about the schedule and the participants and arranges to open the training courses. Trainers are the specialists of the Extension Service Center. In 2001, 56 training courses were carried out in the Peivand RPC, and participants of the training courses were 1,417 man-hour in total.

2） The RPC has trial fields and exhibition fields of 5 to 6 ha to transfer the cultivation techniques to farmers. In 2001, selection trial of wheat varieties were carried out in the trial field of 1 ha, and exhibition of cultivation techniques on 4 crops, such as wheat, barley, cotton, rape, is intended in the next year.

6.1.4 Irrigation and Drainage Conditions

(1) Landuse

The total area of Tazeh-Abad Irrigation Scheme is 3,320ha a and its present land use condition is shown in the following table.

Landuse Condition in Tazeh Abad Project Area

Farm	3,040.0 ha
Farm road	42.0 ha
Residential area	2.0 ha
Pond	150ha (170ha)
Canals	108.0 ha
Total	3,320.0 ha

The area extends under the topographical condition of about 1/1,500 from Northeast to Southwest. The highest elevation is 47.40m at the fareast location of the area and the lowest is 30.90m at the far southwest respectively. Gorgan rivers runs in south side of the scheme.

(2) Irrigation Method and Water Requirement

1) Irrigation Method

The most popular irrigation method in this area is ‘Basin Irrigation Method’. The original intension for introducing this irrigation scheme was as ‘supplemental water supply for dry farming area by taking river water’, not as ‘complete modern irrigation system’ from initial stage. And the system is still under developing stage. Hence farmers do not fully depend on unstable irrigation system and they are still following dry farming practice.

Presently, water management is conducted as mentioned below. At around August, the cooperative starts interviewing farmers on cultivation plan for the next year to calculate irrigation water demand with irrigation schedule in a coming year. While reporting and requesting to the Water Organization, they provide an irrigation schedule by farming plot. After receiving confirmation from the Water Organization, some 20 staffs are employed as ‘Water Watchmen’ temporarily. They are responsible to manage water delivery at each turn-out.

Reference for completion for flooding in one plot is 15 or 20cm water depth at intake mouth for a leveled plot, and 20 to 25cm for an unleveled plot. Frequency of irrigation is 3 times in 9 months for wheat cultivation and 3 times in 8 months for cotton cultivation.

2) Crop Water Requirement

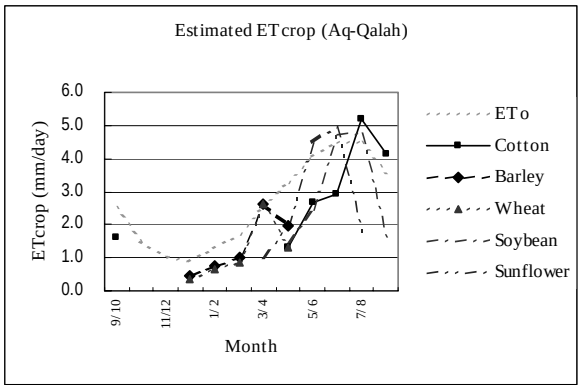
Presently Agriculture Organization is applying a method based on the modified Pennman Method for estimating the crop water requirement. Soil and Water Department, in charge for such planning in the organization, recommends the method based on their experiences.

Estimated Crop Water Requirement at Aq-Qalah (For Tazeh Abad)

unit : mm/day

	Iranian Calendar	7	8	9	10	11	12	1	2	3	4	5	6
	Solar Calendar	9/ 10	10/11	11/12	12/ 1	1/ 2	2/ 3	3/ 4	4/ 5	5/ 6	6/ 7	7/ 8	8/ 9
Aq-Qalah	ETo	2.5	1.5	1	0.9	1.3	1.7	2.5	3.3	4.1	4.5	4.5	3.6
	Cotton	1.62							1.32	2.66	2.92	5.17	4.14
	Barley				0.45	0.78	1.02	2.62	1.98				
	Wheat				0.36	0.65	0.85	2.62	1.32				
	Soybean								1.48	2.46	4.72	4.72	1.62
	Sunflower							1	1.98	4.51	4.95	1.8	

The estimated ETcrop of cotton, wheat, barley, soybean and sunflower are shown in the Table and figure on the right side. The requirements in the dry season increase rapidly to 4 or 5 times of values in wet season. In this dry season river discharge decreases rapidly. Hence it is obvious some countermeasures to secure irrigation water source are required. Alternatives might be a) water reserving facility like farm pond in the scheme 2) establishing water allotment rule to take water from existing dams in the upstream and 3) making rule to draw water through the Army Farm irrigation system, modifying the present system to reach to the scheme.



3) Irrigation efficiency

Irrigation efficiency by method is shown in the right side table. Although land leveling is carried out in most of farm plots, some lots were not leveled having a low irrigation efficiency. Most of irrigation canal networks are left as earth canal, though planned as concrete lining, which is caused due to lack of implementation budget of the Government. Hence net irrigation efficiency is assumed as shown in the above table.

Assumed Irrigation Efficiency by Method

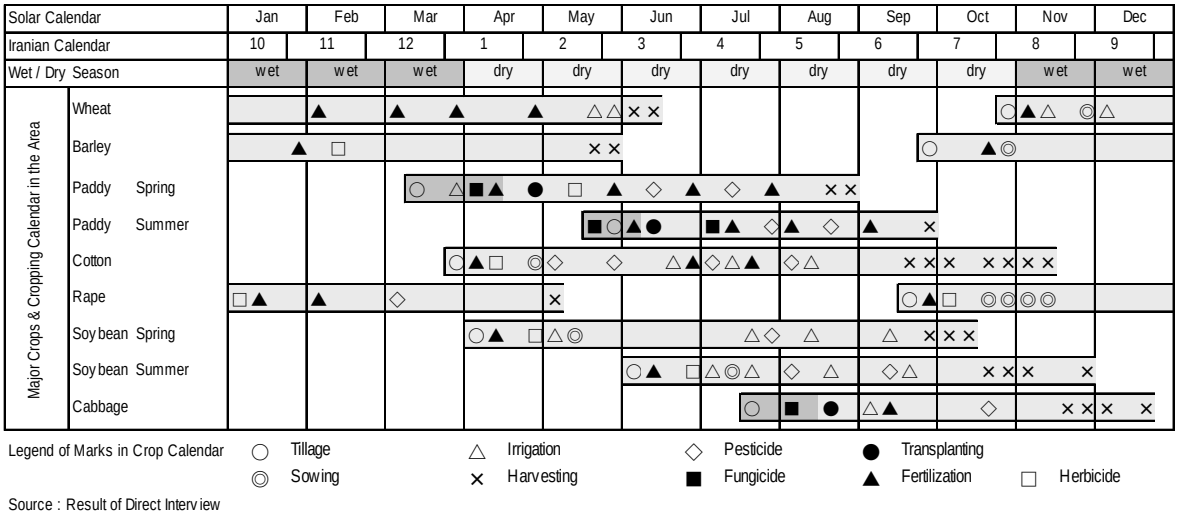
Descriptions		Basin Irrigation		Furrow Irrigation	Sprinkler
		Present	As planned		
Conveyance efficiency	Ec	0.80	0.90	0.90	0.90
Field canal efficiency	Eb	0.80	0.80	0.80	0.90
Field application efficiency	Ea	0.60	0.60	0.70	0.80
Irrigation Efficiency	Ei	0.38	0.43	0.50	0.65

4) Irrigation frequency

The actual irrigation frequency applied by farmers is limited as shown in the figure below. They do not irrigate during the first month after seeding and once a month for November and December. They don't irrigate during winter from January to March / April by May for the last watering just before the harvest, for the wheat.

Similar irrigation practice can be found for cotton. They do not irrigate during the first three months after seeding, and the crop depends on soil water moisture only. Then starts once a month irrigation for three months from June to August. They start cotton harvest from September.

Present Crop Cultivation Schedule



Source : Result of Direct Interview

Such watering practice indicates us that the role of the present irrigation system is just to supply supplemental water to crops to overcome thirsty season. Actually the supplied water functions to relief salt stress, which has been concentrated through, dry season to the ground surface and to supply soil moisture in the season.

5) Irrigation water requirement

The whole annual irrigation water demand for 1,000ha might be estimated as followed table, which indicated 13.18MCM per year per 1,000ha, basing on considerations stated in the previous clauses. (Cropping area for the estimation is 1,000ha whole, not divided and fixed into wheat plot and cotton plot in the estimation).

Estimation of Water Demand for Crop Cultivation

Solar Calendar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Iranian Calendar	10	11	12	1	2	3	4	5	6	7	8	9
Wet / Dry Season	wet	wet	wet	dry	dry	dry	dry	dry	dry	dry	wet	wet
Cropping calendar : Cotton												
Cropping calendar : Wheat												
ET: Cotton mm/day					1.32	2.66	2.92	5.17	4.14	1.62		
ET: Wheat mm/day	0.36	0.65	0.85	2.62	1.32	0						
Effective rainfall mm/mon.	21.6	14.7	16.6	17.7	10.5	14.1	0	0	0	3.6	12.8	18.4
W.demand for 1000ha I&D (MCM)	0.02	0.23	0.38	1.46	0.75	1.52	1.88	3.34	2.59	1.01	0.00	0.00

Annual water requirement for developing 1,000ha I&D scheme ; 13.18 MCM / year / 1,000ha (In case of everyday irrigation practice)

This estimated volume is just a rough estimation to know the scale of the water demand, applying wheat and cotton for the whole scheme area. Actual water requirement might be one sixth of the amount because of one third planting area and farmers are not cultivating cotton and wheat in the same plot.

6) Farmers' recognitions on irrigation water availability

Most of the farmers have an understanding that the irrigation system serves supplemental water to dry farming. It comes from their fixed idea that the river water is not sufficient to depend on their whole cultivation, because they live besides the river and know the discharge conditions. So besides hoping water for irrigation, they do not have strong expectation to the system. Also the cooperative has similar understanding as above.

Such understandings of beneficiaries are considerable aspects for examining irrigation plan as references of technical level, development scheduling and fund allocation under the cost sharing / privatization policy.

(3) Preparation of Topographic Map

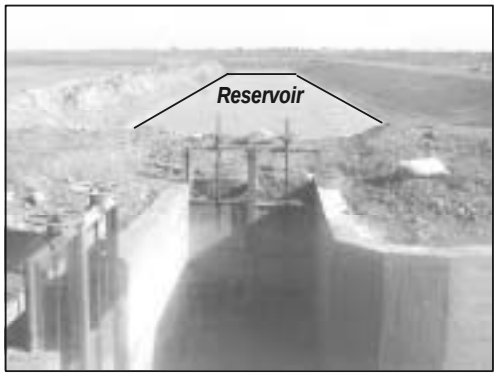
Soil and Water Department has topographic map and cadastral map of the scheme with scale 1/20,000, provided in 1998. All of planning are made based on those maps.

(4) Existing Facilities of Irrigation and Drainage System of the Scheme

The existing facilities of irrigation and drainage system of Tazeh Abad Irrigation Scheme are as follows:

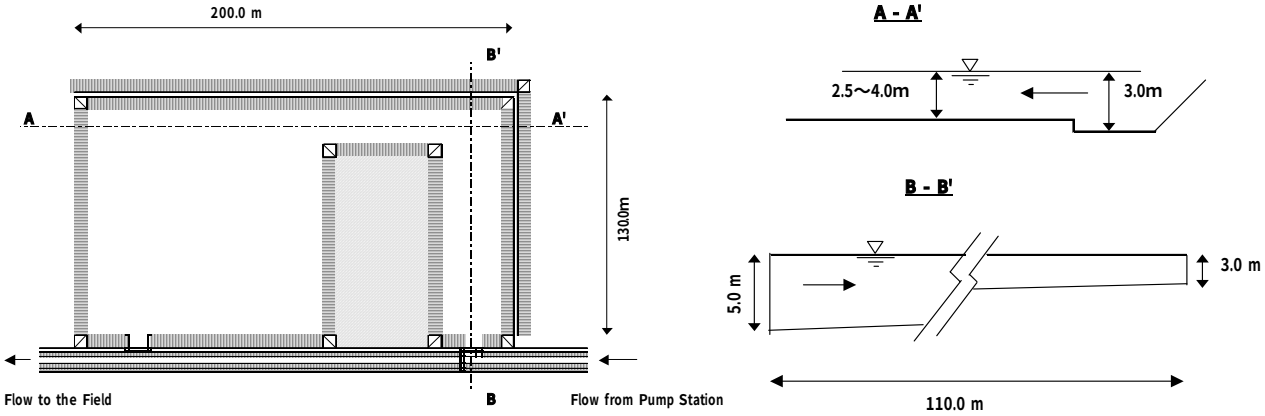
1) Intake facility

Two-story pump house is provided on slop of right side riverbank with 9 centrifugal pumps with 300 lit/sec 25m head capacity with electric motor. Pumps are arranged in a row on semi-underground flour, at 3m below the entrance of the station. There is no de-silting facility on suction side, and instead, suction pipes are set at 50cm above the riverbed with silt screens at each pipe inlet. Since there is no water level regulator in river side and thick muddy condition, efficiency of pump intake varies by season. A fulltime operator who is stationed permanently manages pump operation. Record of pump operation and intake amount has never been kept.



Scene of Diversion Gates to Sediment Depositing Reservoir At Tazeh-Abad Scheme

2) De-Silting Pond



A de-silting pond of 1.5 ha is provided after the pump station, with 2.5 m depth excavated type. Total capacity of the pond is about 100,000CM. It is explained that all of water discharged from the pump is to be reserved in here before distributing irrigation water through main canal.

3) Irrigation Canal

Irrigation canal system consists of 1) Main canal, 2) Secondary canal and 3) Tertiary canal. Main canal is structured with concrete lining commonly with same slope of side wall as 1:1.5, while bottom widths and depth are adapted with different sizes among I&D schemes. Bottom widths vary from 0.55m to 0.76m and a range from 0.8m to 1.25m for the depth respectively. Longitudinal gradient is 1/2,000 or 3/10,000.

Secondary canal is constructed as earth lining structure basically and partially adopting concrete lining, depending on financial sufficiency according to the Government's explanation. Ordinary dimension is as 0.2or 0.3m bottom width, 0.4 or 0.6m as canal depth with gradient of canal side slope of 1:1.5. Longitudinal gradient varies from 1/2,500 to 6/10,000 aiming to attain a conveyance capacity of 70 lit/sec to 120 lit/sec.

Tertiary canal is constructed as earth canal, with dimension of 0.2or 0.3m bottom width, 0.4 or 0.6m as canal depth with gradient of canal side slope of 1:1.5.

4) Drainage Canal

Drain system is consisted of main and secondary drainage canals The original task of the drainage canal was to drain inundated water of seasonal rainfall and to discharge drain of irrigated water from the canal slope.

The dimensions of main canal are as follows: bottom width - 1.0 or 1.5m, side slope gradient - 1:1.5 and canal depth - 2.0 or 2.5m. Longitudinal gradient is set as 1/2,000. The dimensions of secondary canal are as follows: bottom width - 0.5 or 1.0m, side slope gradient - 1:1.5 and canal depth - 0.8 or 1.25m. Longitudinal gradient is set as 1/2,000.

6.2 Constraints and Potentials for Development

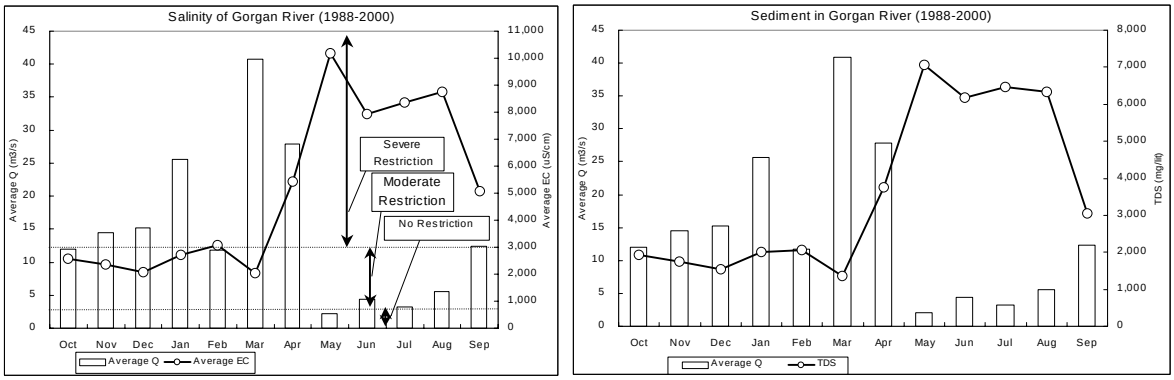
6.2.1 Constraints for the Development

(1) Natural Conditions

1) Hydrology

One of the main restrictions in the study area is the salinity problem of the Gorgan river. The average variation (1989 to 2000) of the salinity during the year is shown in the following figure.

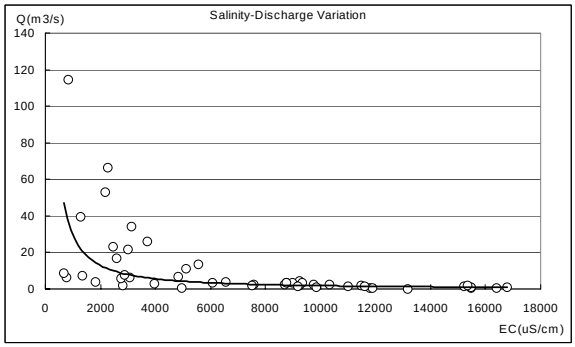
Salinity and Sediment Variation in Gorgan River (Aq Qala)



According to the figure, the salinity and sediment concentration in the Gorgan river varies in similar form. The river water salinity remains in the moderate restriction band for irrigation use from October to March, but after April this value reaches the severe restriction band. The worst months concentrate between May and August, when the EC values reach more than 7,000 μS/cm.

This phenomena has its origin in the Voshmgir dam operation. During February to April, the Voshmgir dam is storing water. So, the only water coming from the dam is the excess water and the water volume managed by the Ministry of Energy. In this period, the rainy season, the Zaringol river and Fazel Abad rivers have enough discharge, being the EC value in the moderate restriction band.

On the other hand, after May, beginning of the dry period, the only water coming from the Voshimgir dam is also the one managed by the Ministry of Energy. But during this period, the base discharge of the river, that comes from the Zaringol and Fazel Abad rivers, are small and includes the drainage water of the agriculture fields. This drainage water includes fertilizers, chemical products, etc. of the farms. That's why the salinity increases to high values.



EC-Q Relation for Aq Qala (Apr-Sep)

The right graphic shows the relation of the discharge and EC for the sampling data. As shown, the high EC values are found when the discharge is low. In other words, it is estimated that the high values are found when the base flow comes from the Zaringol and Fazel Abad rivers during the dry season, and was collected when the discharge was low.

2) Soils

The major problems related to the soils in the Project Area are as follows:

1) Salinization and alkalinization of the soils

2) Drainage and groundwater depth limitation

3) Soil Fertility

As discussed in the previous chapter, the Study Area has salinity and alkalinity ranging from moderate (S2A2) to severe (S3A3) level. Especially, the western part of the Project Area, which has not been irrigated has salinity and alkalinity level of S3A3. The accumulation of excess amounts of soluble salts in the crop root zone is one of the major problems, which reduces the productivity of the soils. This salinization and alkalinization are caused due to various reasons, which includes geological composition of the parent materials of the soils, water quality of Gorgan river, and poor soil and water management.

Although the water applied by irrigation leach out the salts in the root zone temporarily, the salts are percolated downwards to the groundwater, which is at a shallow depth of 1-2m in most of the project area (1989 semi-detailed soil survey). The drained salts again move upwards to the root zone by capillary rise because of insufficient drainage. Although drainage system was installed in the Project area, water application was done only once during the growing season of 2001 because of shortage of water. This small amount of water was not enough for leaching and drainage. The effect of the drainage system can be verified only after applying enough amount of irrigation and drainage water.

Apart from these major limitations, the other limitation is the fertility status of the soil, which varies from a low to moderate level. If leaching is carried out in an extensive manner, then there is fertility problem because of leaching of nutrients. Therefore balanced fertilization and balanced water management practices are necessary.

(2) Socioeconomic Conditions

1) Insufficient fund for the agricultural activities

Preparation of production cost for the next year is a very critical matter for all of the members of RPC Pavand. So as to prepare it, they use Agricultural Bank through the intermediation of the RPC or by themselves. The members can borrow money within the limit of Rls. one

million but it is not enough. Moreover, sometimes the members cannot borrow money due to the limit of allocated budget for the RPC. Obtaining loans from banks (including Agricultural Bank) not through RPC is difficult if he has no connection with the bank and he is offered the worse condition.

2) Characteristic of Turkmen

It is the most difficult to achieve trust from the farmers, especially elder Turkmen who are the majority of RPCs Pavand's members. Some of them insist to their own ways of cultivation and hesitate to introduce new crops. Therefore, it takes time to expand new crop cultivation. Additionally, Turkmen have some religious (Islam Sunni) restriction such as not mixing the soil of his own land with the others.

3) Shortage of staff and fund of RPC Pavand

RPC Pavand does not have enough staff and fund to meet the demand of the members such as providing more technical extension, lending more machinery, and supplying more agricultural inputs.

(3) Agricultural Conditions

There are some prerequisites to prepare the agricultural development plan and to carry out the farming in the Tazeh Abad Project Area as mentioned below:

1) Enough irrigation water in winter and in summer, and making good use of water
2) Enough drainage to leach salt in soil
3) Land readjustment having proper field plot and proper land leveling
4) Proper soil management to promote desalinization, to prevent soil alkalization and to increase soil fertility by increase soil organic matter
5) Selection of suitable crops and livestock to the project area, in consideration of promoting of the agricultural policy of Government, decreasing of social repercussion, and profitableness to farmers.
6) Establishing of cropping pattern and suitable rotation to keep the sustainable farming
7) Establishing of proper cooperative organization in mechanization and maintenance of farm machinery in crop cultivation, management and maintenance of canal and drains, of other facilities, such as plastic green house, etc.
8) Establishing the high productivities in agriculture and husbandry by increase of yield and decrease of cost.
9) Establishing of supporting system for farmers, such as technological transfer of farming, cultivation techniques, profitable marketing, conditions loan to be easy for repayment, guarantee of farm products by Government, etc.
10) Improvement of supply system of farm materials and farm machinery

At present, these prerequisites are not satisfied as mentioned below;

1) The construction of irrigation canal and drains are under construction in the rest part of 1200 ha. And quantity of irrigation water is not enough in summer even after accomplishment of construction.

2) The present design of drains does not have enough spacing. It is required to execute drains in fields with reasonable cost to carry out effective and prompt desalinization in soil.

3) At present, there are many plots of small size and over-large size. Besides, leveling of field plots is very important for effective irrigation and increase of yield of crops. It is required to improve the field plot size and field leveling.

4) At present in the project area, the technologies of soil management, such as pre-irrigation for desalinization, fertilization of sulfur to prevent alkalization of soil, fertilization of micro-nutrients, etc., are not enough even though the RPC efforts to transfer the technologies. According to the leader of Peivand RPC, 70% of farmers in Tazeh Abad do not have knowledge on leaching salt by pre-irrigation. As a result of extension activities of RPC, pre-irrigation was carried out in 450 ha in winter in 2001, however, in only 38 ha in summer in 2002. To promote the pre-irrigation, the RPC executed the water charge cut from 100,000 Rls./ha to 80,000 Rls.

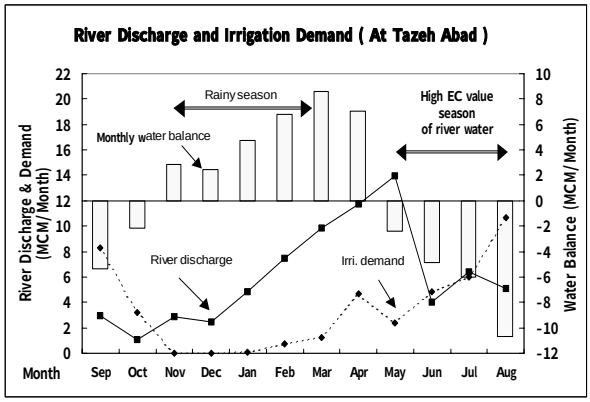
5) In the project area, the crop rotation is not established.

6) At present, the RPC has the seven sub-organizations to communicate within RPC and seven Dehs. However, the organizations of mechanization and maintenance of farm machines in crop cultivation, management and maintenance of canal and drains, of other facilities are not yet in the project area.

7) The support systems for farmers are not enough.

(4) Irrigation and Drainage

The farmers in the project area have been managing their crop production under dry farming condition for several generations. Background of the present I&D scheme were to set some measures to assist the unstable crop production by supplying supplemental water, expecting an yield increase without any clear aims of the goal of assistances from the Government to farmers. By this meaning



most of farmers are expressing gratitude for the measures taken by the Government. It can be said that both of the Government and farmers have never clarified concrete targets through the activities of introducing irrigation system. The major constraints related to irrigation and drainage are discussed below.

1) Unstable availability of irrigation water

The major problem is unstable supply of irrigation water in the Project area. Solution alternatives for this constrain might be a) to secure surplus water with optimum dam operation in the upstream, b) to provide scheme-base water storage facility like farm pond to reserve river water in wet season utilization in dry season. Actually Soil & Water Dept. has already commenced the action and now a 4MCM capacity pond is under construction. Besides that still most of the farmers have never received water for irrigation and been keeping dry farming also within the scheme area.

Solution of this unstable and unreliable aspect of water source is one of the most primal subjects for the agricultural development in Gorgan Plain including this I&D scheme. Possible alternatives might be summarized as followers.

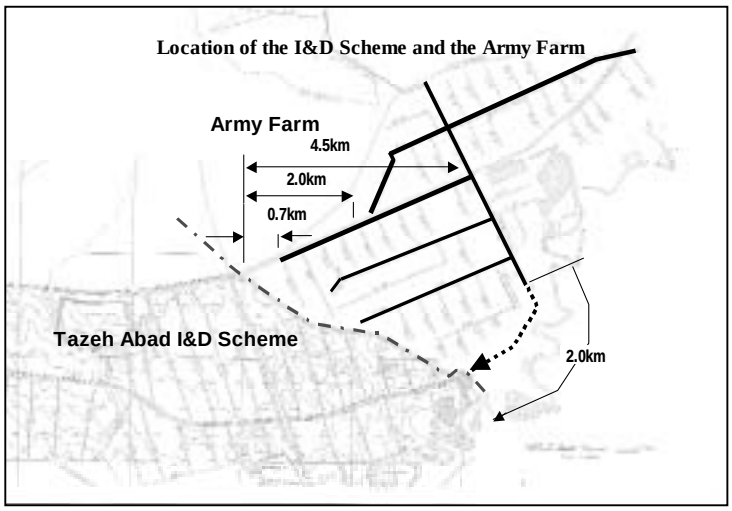
a. To provide farm pond
b. To establish water allocation rule among dams, water users / farmers, sectors in upstream and downstream.
c. To extend Army Farm canal
d. To enhance water saving practice

Among the alternatives a 4MCM, 150ha farm pond is under construction by the Soil & Water Department in the scheme. The aim of the provision is to serve irrigation water to lower elevation 600ha farmland in downstream area to cultivate cotton in dry season. It means other some 2,400ha in the upstream side are not available to receive the water, in case of without pump.

Alternatives of Water Source Development for the I&D Scheme

Alternatives	Descriptions
1 To provide farm pond (Direct measure)	A sufficient capacity farm pond is to be constructed or obtained to overcome the demand in dry season, if would like to realize higher income agriculture.
	Required capacity to conduct 100% cultivation through the year is to be 12MCM / 1,000ha farm scale.
	Required area for the pond is to be about 10% of scheme area (Depth 3.0m, effective depth : 2.5m)
	And the cost for water use from the pond is to be heavy burden for farmers because not available to use gravity in the region.
2 To establish water allocation rule among dams, water users / farmers, sectors in upstream and downstream. (Indirect measure)	Actually any rules are never established to secure downstream farmers' water right. Just used water in upstream area.
	Most of new developed dams stores whole river discharge hence downstream farmers are losing water availability not only dry season but also wet season.
3 To extend Army Farm canal (Direct measure)	It seems most applicable and economical measure to secure stable and clean water to the said scheme from Gorgan Dam, just extending few km from the end to the scheme.
	All of stakeholders seems not to touch with "Army".
4 To enhance water saving practice (Indirect way)	This is indispensable approach to secure available water for downstream agriculture because total agricultural area in upstream is about 30,000ha.
	10% improvement can make 3,000ha demanded water in downstream famland.
	Both of A.O & W.O should establish rules to guide farmers to save irrigation water in upstream.
	Of cource the rule should be adapted for the down stream farmers as responcibility of water user in water scarce region.

The system required to convey the water to the upstream might be a pipeline for about some 7km distance with intake pump at the pond and boosting pump in the intermediate. It is obvious that the water cost becomes quite expensive with this measure.



The 3rd alternative is an idea to convey water through existing irrigation canal network with some extension of it to connect to Tazeh Abad scheme. Water source of the Army Farm is reserved water at Gorgan Dam in the upstream. The water at the Army Farm is clean without sediment and sufficient enough to use for sprinkler irrigation directly because the water is already de-silted in the dam. Some reserving facility is required in the dam or in downstream vicinity to store the water for dry season irrigation. The most realistic measure to obtain the reserve might be excavation or removal of dam sedimentation. Since it is out of the scope of this study, further discussion is left to the Iranian side.

The 4th alternative is an indirect measure but it might be the most realistic and effective one to increase water availability for the downstream in the semi-arid condition. It is said that some 30,000ha area has already been developed related with those two dam development in the upstream. If they use the new developed water in reckless management and consume the precious water there, then possibility of future development of agriculture in the Gorgan Plain shall be negative. So both of MoE as in charge for water resources management and MoA for on-farm management should commence necessary actions urgently for this subject.

Alternative No.2 might be a measure after commence other three alternatives. The present scarcity of water in the downstream has become bigger by the dam construction in the upstream side. It means that the responsible agencies did not consider or the plain agriculture was ignored on the right of water use of the river. Overall water resource allocation rule is necessary for this region to make concrete future development.

2) Uncompleted irrigation canal networks

Achievement of canal provision is still under developing against the original plan as 506m Main canal, 32,141m Secondary canal and 53,018m. Most of the network has never been provided concrete lining. The water conveyance efficiency of without

Achievement of Irrigation Canal Provision

unit : m & %

	Primary canal	Secondary canal	Tertiary canal
By original plan	505.9	32141.7	53018.6
Completion	505.9	26222.6	41349.1
Achievement (%)	100%	81.6%	78.0%
Lining plan	505.9	32141.7	53018.6
Completion	505.9	5177.1	0.0
Achievement (%)	100%	16.1%	0

lining is 0.64 against 0.72 of lining canal. This means 36% of precious intake water is to be lost. So as soon as possible the necessary measure should be completed.

3) Insufficient drainage network for salt leaching

Existing drainage system in the project is open channel type with about 400m-interval combined with irrigation canal and farm road. According to the results of interviews to farmers there they complain salt hazard on crop cultivation and they cannot introduce crops like beans or grasses which are classified as weak salt tolerance crop. It means that continuous leaching activities are indispensable while conducting irrigation, though being limited availability of water source. Hence some additional drainage system is to be introduced as intermediate drain which might be open channel type or pipe drain type.

It is necessary to provide additional drainage to generate vertical water movement and to receive such leaching water and to drain it horizontally. Sub-surface drainage system owes such function, which variation are like a) mole drain without any material, just making continuous hole space horizontally b) porous pipe drainage made with concrete, plastic or others. The most cheapest type is mole drainage system without any material. But it required some 30 or 35% clay content in the layer as minimum rate to be placed to keep mole structure. So trial in the site and monitoring is necessary before introduction.

4) I&D system has no water measuring function.

Presently all of the relevant agencies, farmers and cooperative are not keeping record of water consumption of the project. It can be said that the present situation between W.O and Cooperative is like Cooperative, as water user, purchasing water from W.O, as water business firm. Recently it is said that W.O decided to introduce area based unit price setting. But the total cost to be paid from the cooperative to W.O will never be adjusted by the achievement just by area proposed in annual initial season. To improve such condition, water measuring system is necessary.

5) Present farmland condition is not leveled to conduct proper irrigation

It is inevitable to avoid land leveling for making farmland plain with proper gradient to accept and to conduct parity watering for 7.0 ha, as average area of one plot. But achievement of land leveling by today is just 100ha against 3,200ha. The cooperative has a plan to do it for other 100 ha within this coming year.

As farmers' explanation it seems difficult to deliver the water up to the end of a plot even though intaking water with 20 or 25cm depth at intake mouth of a plot. Land leveling is inevitable to improve such condition. Also this measure can be the first step to introduce furrow irrigation method among farmers which is expected as water saving comparatively.

6.2.2 Potentials for Development

(1) Water Resources

The surface water is the main resource for the agriculture along the Gorgan river. The Tazeh Abad irrigation scheme also takes water from the same river.

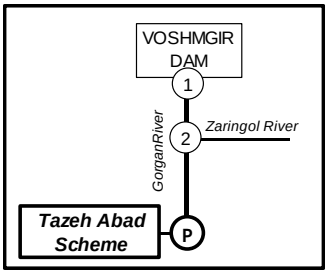
Let's revise the potential of the water resources in the area. The main water sources for the Tazeh Abad scheme are the Voshmgir dam and Zaringol river. As shown in the before, the available water volume from these sources are as follow:

Available Water for 10 Years Return Period Rainfall

(MCM)

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Voshmgir Dam	0.8	0.6	0.4	0.4	0.7	2.2	6.0	5.8	3.6	6.4	5.1	2.0	34.0
Zaringol River	0.2	2.3	2.1	4.4	6.8	7.6	5.7	8.2	0.4	0.0	0.0	1.0	38.8

The actual estimated available discharge is 34 MCM/year from the Voshmgir dam and 38.8 MCM/year from the Zaringol river (points 1 and 2 of the right figure) for a rainfall of 10 years return period.



If the salinity problem is considered, the water between May and September will have some restriction to be used as irrigation water. So, the available water at the above points will be the following if the salty water is excluded.

Available Water Considering the Salt Problem in Gorgan River (MCM)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Voshmgir Dam	0.4	0.7	2.2	6.0	2.3	0.0	0.0	0.0	0.8	0.8	0.6	0.4	14.2
Zaringol River	4.4	6.8	7.6	5.7	3.3	0.0	0.0	0.0	0.4	0.2	2.3	2.1	32.8
TOTAL	4.8	7.5	9.8	11.7	5.6	0.0	0.0	0.0	1.2	1.0	2.9	2.5	47.0

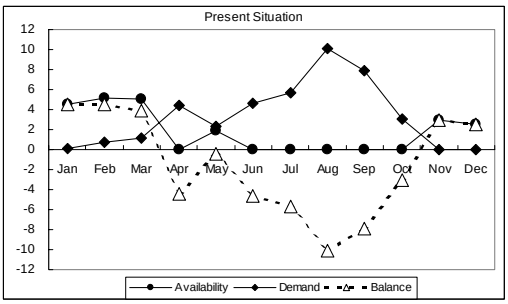
a-1) Irrigation Potential for the Actual Condition

According to this, the estimated available water at the Tazeh Abad pump station for the present water use is as shown in the next table.

Present Water Availability and Water Balance at Tazeh Abad Pump Station (MCM)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Availability	MCM)	4.6	5.2	5.1	0.0	1.9	0.0	0.0	0.0	0.0	0.0	2.9	2.5
Demand	MCM	0.1	0.7	1.2	4.4	2.3	4.6	5.7	10.2	7.9	3.1	0.0	0.0
Balance	MCM	4.5	4.5	3.9	-4.4	-0.4	-4.6	-5.7	-10.2	-7.9	-3.1	2.9	2.5

As shown in the right figure, there is water shortage in Tazeh Abad Scheme between April to October if the present water use condition prevails.



Present Water Availability at Tazeh Abad Pump Statt

a-2) Irrigation Potential for the Plan

The same water balance will be as follow, if the cropping method presented in this study is adopted.

Planned Water Balance at Tazeh Abad Pump Station for Basin Irrigation (MCM)

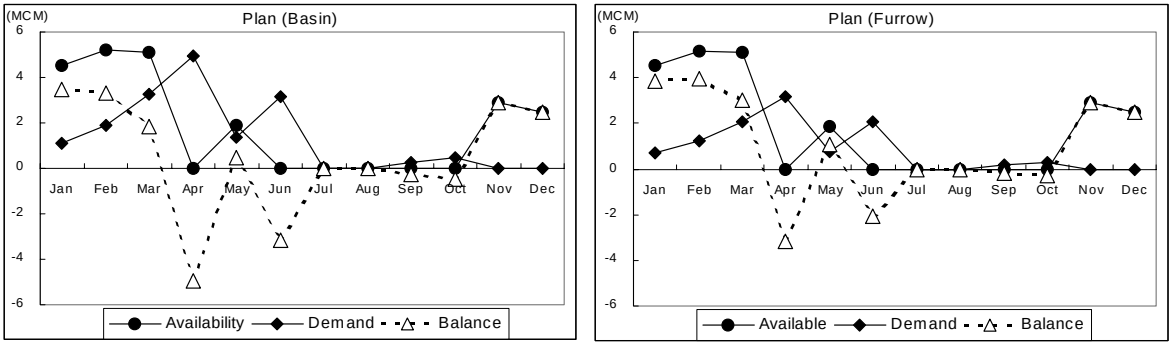
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Availability	4.6	5.2	5.1	0.0	1.9	0.0	0.0	0.0	0.0	0.0	2.9	2.5
Demand	1.1	1.9	3.2	5.0	1.4	3.2	0.0	0.0	0.3	0.5	0.0	0.0
Balance	3.5	3.3	1.9	-5.0	0.5	-3.2	0.0	0.0	-0.3	-0.5	2.9	2.5

Planned Water Balance at Tazeh Abad Pump Station for Furrow Irrigation (MCM)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Availability	4.6	5.2	5.1	0.0	1.9	0.0	0.0	0.0	0.0	0.0	2.9	2.5
Demand	0.7	1.2	2.1	3.2	0.8	2.1	0.0	0.0	0.2	0.3	0.0	0.0
Balance	3.9	4.0	3.0	-3.2	1.1	-2.1	0.0	0.0	-0.2	-0.3	2.9	2.5

The following figure shows the water balance at the Tazeh Abad pump station if the proposed agricultural methods are adopted.

Planned Water Availability at Tazeh Abad Pump Station



As seem in the graphics, there are water shortage mainly in April and June.

(2) Pevand Cooperative and its Members

1) High motivation of the representatives of RPCs Pavand members

Most of the members are in great difficulty of living and have high motivation to improve their living condition based on agriculture. The representatives of the members are sure to cooperate with applying new agricultural method in order to improve their living condition through increasing agricultural production.

2) High potential of RPCs Pavand as an organization

Foundation of the organization is completing because of having a good RPCs President although unfortunately he will be replaced soon. In addition, there is hope for managing RPCs by itself because the current balance has been good.

6.3 Agricultural Development Plan

6.3.1 Outline of the Development Plan

(1) Considerations for the Agriculture Development Plan

1) Considerations

The following aspects are considered for the agriculture development plan.

1. The development plan should concentrate on income increment of farmers.

In consideration of the available resources for further development, the development plan should concentrate on increasing income of farmers, who are stuck in the condition of dry farming.

2. The plan should be made such that the cost burden on the farmers will be low.

Most of the farmers are already under burden of debt under the ‘cost sharing policy’, and therefore, the planning should be made such that the cost allocation by the farmers will be low, by considering an effective and low cost project plan.

3. The plan shall be in the line with phased development, distinguishing what farmers can do

The plan shall be in the line with phased development, and shall clearly distinguish what farmers can do or not. It is quite difficult to make the farmers to be responsible for the all the development activities, who are carrying out farming at individual level with small scale investments.

4. The plan is to be on the line with effective use of uncertain water resources

Most of the constraints of the Project are originated with uncertain water resources. Therefore, the plan should focus on the effective use on uncertain water resources.

2) Placement of This Plan

The main subject of this study is ‘to show an example of agricultural development in the Gorgan Plain, considering the natural and socio-economical conditions’ and Tazeh Abad I&D Scheme is selected as an example area. The scheme has just started its development activities while receiving supports and efforts of engineers and specialists individually, but not yet reached its initial target of supplying irrigation water to all the area. Now both of the government and the farmers are expecting the completion of the first development stage as early as possible. Based on such circumstances and its present conditions, it is confirmed that the placement of this plan is as follows;

1. This plan has to bridge the gap which the scheme has never been reached to the goal of the initial stage even though several years have passed after the project commencement,
2. This plan will be the first step to fulfill the gap in line with phased development to approach stable agriculture based on irrigation.
3. The agriculture development shall fully consider the farmers’ cultural background and deal with market situation.

(2) Components of Agriculture Development Plan

In consideration of the severe environmental conditions of the area, the agriculture development plan consisting of the following plans is prepared, in order to achieve sustainable agriculture and to provide stable income for the farmers.

1. Farming Plan
2. Irrigation and Drainage Facilities Improvement Plan
3. RPC Strengthening Plan

Each of the plans is described below in detail.

6.3.2 Farming Plan

(1) Proposed Farming and Cropping System

The farming plan is composed of crop production with crop rotation, hybrid cow farming of 10 heads, and cucumber production in plastic green house for the farmers of small-scale farming.

To execute the proposed plan, there are some requisites, such as supply of required irrigation water, drainage for decrease of salinity in soil in order to cultivate the crops, which have poor resistance to salt, such as pea, maize, etc. It might take several years to remove salt after accomplishment of construction of canal and drains.

The proposed cropping system is one of the models of crop rotation. Various changes can be made in the model by change of crops with process of desalinization or with farming scales.

Especially, the small-scale farmers could not help introducing vegetables in exchange for cotton and pea in order to increase the profits. Besides, all the farmers could introduce tomatoes for processing in change for cotton under contract between RPC and processing factories.

The proposed rotation is as follows:

1）Four-year rotation is adopted, because the number of main crops in winter is four (Fig. 6.3.1).

2）Five (5) crops included in the rotation, such as wheat, annual grass (e.g. Italian ryegrass), rape, cotton and pea. The growth periods of various crops are shown in Table 6.3.1 and Fig. 6.3.2. Crop rotation is made by the combination of these growth periods of crops. Besides, the plan is considered carefully on shortage of irrigation water in July.

3）The cropping pattern is “wheat – annual grass – rape – cotton – pea”.

4）In the plan, a farmer divides his own field into four plots and cultivates four cropping patterns every year as shown in Fig. 6.3.1. Therefore, the farmer shall produce 5 crops every year to keep balance of agricultural income every year

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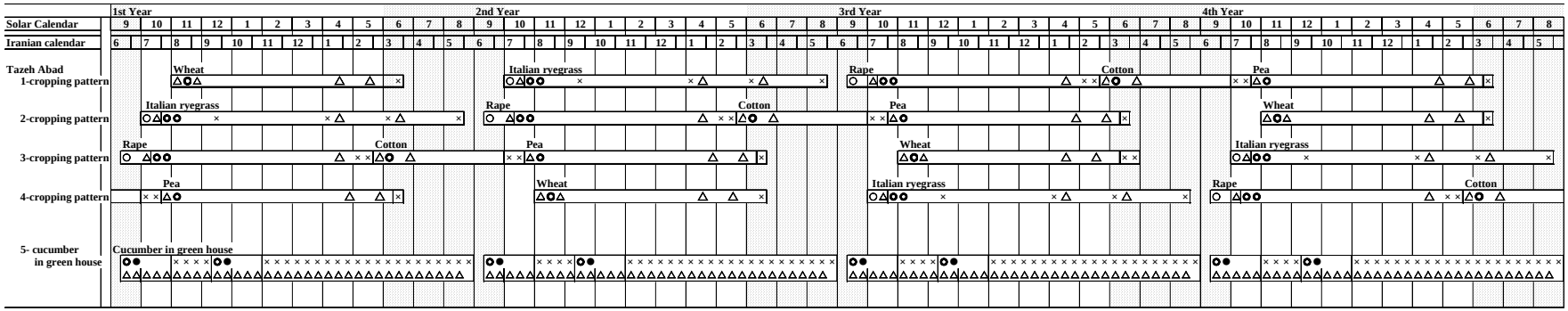
Fig. 6.3.1 Growth Period and Rotation of Crops (Plan for Tazeh-abad)



Note 1) ◎ Sowing ● - Transplanting △ - Irrigation × - Harvesting

2) Dry season

3) In the both survey area, the four-year crop rotation is adopted. The composed crops in the rotation are wheat, rape, grasses (Italian ryegrass), pulse crops (pea) as winter crops, and cotton, as summer crops.

4) Livestock farming, which each farmer raises mother cows of 10 heads, is carried out by each farmer besides above mentioned farming.

5) In small scale farm households, a cucumber cultivation throughout the year in a greenhouse is introduced.

Water Demand

Case of " Basin Irrigation " method 16.43 MCM/Year/Whole Farm Plot

Solar Calendar	9	10	11	12	1	2	3	4	5	6	7	8
Iranian calendar	6	7	8	9	10	11	12	1	2	3	4	5
Irri demand (MCM/month/Scheme)	0.25	0.47	0.00	0.00	1.10	1.89	3.24	4.95	1.39	3.15	0.00	0.00
River discharge (MCM/month)	0.00	0.00	2.90	2.50	4.60	5.20	5.10	0.00	1.90	0.00	0.00	0.00
Balance (MCM / month)	-0.25	-0.47	2.90	2.50	3.50	3.31	1.86	-4.95	0.51	-3.15	0.00	0.00

Case of " Furrow Irrigation " method 10.47 MCM/Year/Whole Farm Plot

Solar Calendar	9	10	11	12	1	2	3	4	5	6	7	8
Iranian calendar	6	7	8	9	10	11	12	1	2	3	4	5
Irri demand (MCM/month/Scheme)	0.16	0.30	0.00	0.00	0.70	1.21	2.08	3.18	0.78	2.05	0.00	0.00
River discharge (MCM/month)	0.00	0.00	2.90	2.50	4.60	5.20	5.10	0.00	1.90	0.00	0.00	0.00
Balance (MCM / month)	-0.16	-0.30	2.90	2.50	3.90	3.99	3.02	-3.18	1.12	-2.05	0.00	0.00

Note :

a. Assumed irrigation method for the above estimation is "Basin Method" for farm field with 0.43 efficiency.

b. Besides that irrigation efficiency for the green house is 90% for the caluculation.

c. River discharge from the mid June to the mid Sep is assumed not available for intake due to the quality.

Fig. 6.3.2 Growth Period of Crops

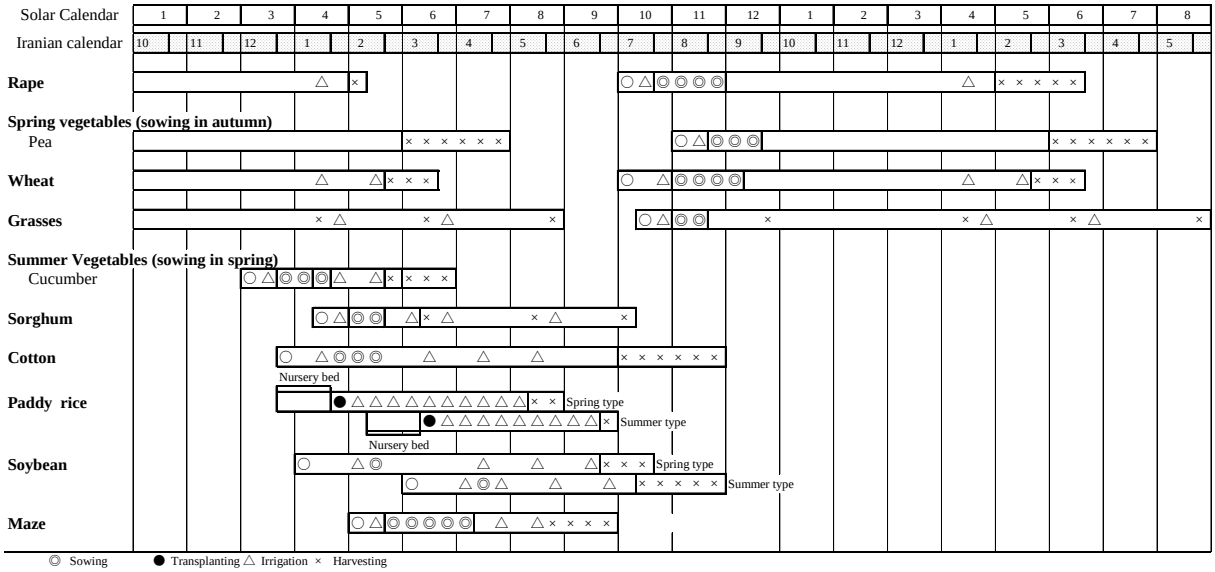


Table 6.3.1 Growth Periods of Crops

Crops	Type	Sowing (planting) time	Transplanting time	Harvesting time
Wheat		Early in Nov. - Early in Dec.		May - Middle of Jun.
Paddy rice	Spring type	Early Apr.	May	Early of Sept.
	Summer type	Middle of May	Jun.	End of Sept.
Soybean	Spring type	May		Oct.
	Summer type	Middle of jun.		Oct. - Nov.
Cotton		Apr. - Early in May		Oct. - End of Nov.
Potatoes	Winter type	Dec. ~ Jan. (for Mahtar Kalateh)	(main)	May ~Jun.
	Autumn type	End of Aug.	(only 50~60 ha in Golestan)	May ~Jun.
Cumin Caraway				
Rape	Hayola 401	Late in Oct.~end of Nov.		May ~ Jun.
Onion	Spring type	Late in Jan.~middle of Mar.	After about 20 days from sowing	Aug.~ Sept.
Eggplant	Spring type	End of Mar. - middle of Apr.	After about 20 days from sowing	Jul. - Oct.
Green bean	Winter type	Apr. and Jul. (2 times or 3 times)		Apr.
Pea	Dry pea	Late in Nov. ~ late in Dec.		Jun. ~ Jul.
Cow pea	Winter type	Late in Apr. & Jul. ~ early in Aug.	(2 times)	Sept.
Cucumber	Spring type	End of Mar. - late in Apr.	After about 20 days from sowing	May - Jul.
Melon	Spring type	End of Mar. - Apr.	After about 20 days from sowing	Jun. ~ Sept.
Spinach	Winter type	Oct. ~ Nov.		Dec. ~ May
	Spring type	Feb. ~ Mar.		May
Cabbage	Winter type	Late in Oct. ~ late in Nov.	After about 20 days from sowing	Feb. - Early of mar.
Annual grass	Winter type	Oct. - Nov.		Dec. - Aug.
Maze		May ~ Jul.		Aug. - Sep.

5) The reasons for selecting these crops are as follows:

① Cotton: Recently, the profit by cotton cultivation has decreased year by year. However, production of cotton has a long history in Golestan, and there are many related enterprises and factories in Golestan Province. Cotton should be selected in rotation to avoid the social repercussion.

② Wheat: Wheat is the staple food in Iran and is one of the crops of low self-sufficiency in the country.

③ Rape: The Government promotes the oil seed production as one of the agricultural policy.

④ Grass: Soil organic matter is very important to improve soil physical characteristics and soil fertility. Grasses leave a lot of root and stubble in soil as compared with that of maize and sorghum. The soil of the surveyed area contains low soil organic matter and shows low CEC. Therefore, introduction of annual grass in the crop rotation in Tazeh Abad is indispensable. Besides, the Government also promotes also grasses production as one of the agricultural policy. With regard to marketing of grass, it is considered that the demand of the dairy farmers in the foot region of Elbourz Mountains in Golestan Province, where Holstein or hybrid cow is raised, grass hay with high quality is very high. In the proposed model, farmers will raise the hybrid cow and will also need the grass hay with high quality, instead of hay of wheat straw in traditional dairy farming of the local breeds. Farmers can choose the sale to the dairy farmers in the foot region or for the self-consumption of their own hybrid cows. In the plan, grass of first harvesting in December is used by own livestock, and hay making is carried out in the second to the fourth harvesting. Hay is sold or used as roughage for own livestock.

⑤ Pea: There are many kinds of pulse in Iran. Pulse is consumed in much quantity in Iran, and exported. Fresh vegetables cannot be adopted in the production model of the project area, because fresh vegetables of several hundreds ha could not be stored or processed before decay. Dried pea is suitable for storage. If there are other suitable pulses, pea may be changed to other pulses.

6) It is required to examine the kind of suitable annual grasses and suitable pulses beforehand in Tazeh Abad.

7) When the farmer cultivates each cropping pattern in every one ha, the annual profits by cultivation of five crops will be as shown in Table 6.3.2.

Table 6.3.2 Annual Profits by Crops in Tazeh Abad

Crops		Cotton	Wheat	Rape	Grass	Pea
Cost	Land preparation	334,120	162,700	275,760	-	235,330
(Rls./ha)	Sowing	270,850	421,050	148,760	-	319,300
	Management	1,448,890	284,110	407,780	-	387,960
	Harvesting	878,840	200,440	166,280	-	384,820
Total	Million Rls./ha	2.933	1.068	0.999	1.365	1.327
Yield	kg/ha	1,704	2,541	2,000	4,000	1,000
Unit price	Rls./kg	2,850	1,050	2,050	825	1,870
Gross income	Million Rls./ha	4.856	2.668	4.100	3.300	1.870
Net income	Million Rls./ha	1.924	1.600	3.101	1.935	0.543

Note: 1) Average yields of cotton, wheat and rape are used. Yields of grass and pea are the estimated figures.
2) Average costs in Golestan Province and unit prices of crops, except grass, are used.
3) Cost and unit price of grass are estimated in Table 6.3.8.

The net income of cultivation of 4 ha is about 9.1 million Rls.

(2) Animal Husbandry

As mentioned above, animal husbandry in Tazeh Abad is carried out with traditional methods. It is necessary to promote the modernization of livestock farming.

According to the farmers' survey of 128 farm households in 4 districts of the survey area, about 80% of the farmers intend to introduce dairy cattle of 10 heads in average in Aq Qala District, because of unstable crop cultivation due to shortage of irrigation water.

The husbandry department of the Golestan Jihad-e-Agriculture Organization planned the hybrid cow farming of 10 heads. We adopted the plan as the agricultural development model of the modernization of husbandry. That is to say, the model is the integrated farming of agriculture and hybrid cow farming of 10 heads.

The plan is shown in Table 6.3.3 in detail. Outline of the plan is as follows;

1) Buildings: mother cow stall of 40m^2, 3 stalls for young cattle and calves of 28 m^2 in total, storage room of 12 m^2, and paddock of 80 m^2. Cost is about 19 million Rls.

2) Facilities: milker, milk storage tank, etc. Cost is about 7.35 million Rls.

3) Purchase cost of cows of 10 heads is 55 million Rls. Investment costs (1), 2), and 3)) is about 82 million Rls. in total.

4) Annual running cost is about 23 million Rls.

5) Annual gross income is 27 million Rls. by sale of milk, 10 million Rls., by sale of bull, 12 million Rls., by sale of young cow, etc., about 49 million Rls. in total.

Table 6.3.3 Plan of Hybrid Cow (Hybrid Local Cow with Holstein) Farming of 10 Heads

No.	Items	Price Mill. Rls.	Remarks
1	Investment		
	1) Buildings	19.404	
	2) Facilities	7.350	
	3) Purchase of 10 heads cows	55.000	
	Total	**81.754**	
2	Annual running cost	**23.330**	
3	Annual total cost	**24.596**	
4	Annual gross income	**49.120**	
5	Balance		
	Cash income	49.120	
	Production cost	24.596	
	Net income	**24.524**	
6	Repayment of loan		
	Amount of annual repayment	14.716	Amount of loan; 90% of total investment,
	Annual interest	6.181	Annual interest rate; 8.4%
	Sum	**20.897**	
7	Net income during 5 years of repayment of loan	**4.893**	

Source: Golestan Jihad-e-Agriculture Organization, husbandry Department

6) Annual net income is about 24.5 million Rls.

7) Repayment of loan during 5 years is about 21 million Rls.

8) Therefore, the net income during 5 years of repayment of loan is about 3.6 million Rls. After 5 years from commencement of the plan, the net income will become about 24.5 million Rls.

(3) Economy of the integrated farming plan

Annual profits in the integrated farming of agriculture of 4 ha and animal husbandry raising of hybrid cows of 10 heads are shown in Table 6.3.4. In this case, the average in Aq Qala is used as yields of cotton, wheat and rape. Yields of grass and pea are the estimated figures. Besides, the average in Golestan Province is used as costs and unit prices of crops, except grass. The net incomes are composed of 1.6 million Rls. of wheat, 3.1 million Rls. of rape, 1.9 million Rls. of grass, 0.5 million Rls. of pea, 1.9 million Rls. of cotton, and 24.5 million Rls. of stock farming, 33.6 million Rls. in total. However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, Annual profits of the integrated farming become about 13 million Rls.

On the other hand, in case of the same integrated farming with high level of technology, the net incomes are composed of 3.1 million Rls. of wheat, 3.9 million Rls. of rape, 1.9 million Rls. of grass, 1.0 million Rls. of pea, 0.8 million Rls. of cotton, and 24.5 million Rls. of stock farming, 35 million Rls. in total (Table 6.3.5).

Table 6.3.4 Annual Profits of Farm household in Farming of 4 ha in Tazeh Abad (Average Plan)
(5 crops cultivation under irrigation in 4-years rotation and raising of hybrid local cows of 10 heads)

Item	Yield kg/ha	Producers' unit price Rls./kg	Gross income Million Rls./ha	Production cost Million Rls./ha	Net income Million Rls./ha	Base of estimate
Crops introduced to the plan						
Wheat	2,541	1,050	2.668	1.068	1.600	Note 1), 2)
Rape	2,000	2,050	4.100	0.999	3.101	Note 1), 2)
Grass (hay)	4,000	825	3.300	1.365	1.935	Note 1), 3)
Pea	1,000	1,870	1.870	1.327	0.543	Note 1), 2)
Cotton	1,704	2,850	4.856	2.933	1.923	Note 1), 2)
Total annual net income of 4 ha in four-year crop rotation					9.102	
Animal husbandry						
Raising of hybrid cows of 10 head			49.120	24.596	24.524	Note 5)
Total annual net income					33.626	

Note:

1) Yields of cotton, wheat and rape are used the average in Aq Qala. Yields of grass and pea are the estimated figures.

2) Costs and unit prices of crops, except grass, are used the average in Golestan Province.

3) Cost and unit price of grass are estimated in Table 6.3.8.

4) Gross income , production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table 6.3.3).

Table 6.3.5 Annual Profits of Farm household in Farming of 4 ha in Tazeh Abad (High Level Plan)

Item	Yield kg/ha	Producers' unit price Rls./kg	Gross income Million Rls./ha	Production cost Million Rls./ha	Net income Million Rls./ha	Base of estimate
Crops introduced to the plan						
Wheat	4,000	1,050	4.200	1.110	3.090	Note 1), 2)
Rape	2,500	2,05	5.125	1.214	3.911	Note 1), 2)
Grass (hay)	4,000	825	3.300	1.365	1.935	Note 1), 3)
Pea	1,500	1,870	2.805	1.789	1.016	Note 1), 2)
Cotton	2,000	2,850	5.700	4.870	0.830	Note 1), 2)
Total annual net income of 4 ha in four-year crop rotation					10.782	
Animal husbandry						
Raising of hybrid cows of 10 head			49.120	24.596	24.524	Note 5)
Total annual net income					35.306	

Note :

1) With regard to yields, the highest yield of cotton, wheat, and rape were used in Tazeh-abad at present. Data of yield of grass and pea are the estimated figures.

2) Wheat, cotton, rape and pea: Data were examined about each component of production costs. The average (2000-2001) in Golestan Province was generally used. Besides, the necessary fertilizer, such as potassium, sulfur, micro-elements, etc..
irrigation water charge in Peivand RPC and repayment of debts to RPC were added with actual cost (Table 6.3.6, 6.3.7).

3) On annual grasses, there is no data on production costs in detail. Therefore, cost of each component of production costs were made with reference to that of wheat and cotton. 4 tons of hay was estimated as total yield per ha of 3 times harvesting (Table 6.3.8).

4) Gross income, production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table 6.3.3).

However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, Annual profits of the integrated farming become about 16.5 million Rls.. In this case, with regard to yields, the highest yield of cotton, wheat, and rape in Tazeh Abad at present are used as yields in the Table. Yields are 4 tons per ha of wheat, 2.5 tons per ha of rape, 4 tons per ha of grass, 1.5 tons per ha of pea, and 2 tons per ha of cotton, respectively. Data of yield of grass and pea are the estimated figures. Data of production costs of wheat, cotton, grass, rape and pea were examined about each component of production costs. The average (2000 ~ 2001) in Golestan Province was generally used. Besides, the necessary fertilizer, such as potassium, sulfur, micro-elements, etc., irrigation charge in Peivand RPC and repayment of debts to RPC were added with actual costs (Table 6.3.6 and 6.3.7). On annual grass, each component of production costs is made with reference to that of wheat and cotton (Table 6.3.8).

It is considered that the integrated farming model of high level is the feasible development plan in near future.

(4) Cultivation System

As mentioned in the economy of the integrated farming plan, to increase yields and profits, there are necessary techniques of farming as follows;

① Strict enforcement of pre-irrigation
② Fertilization of sulfur, micro-elements
③ Organization of land use, mechanization in small scale farming and of irrigation, and conscientiously keeping of the rule in the organization
④ Participation to the training courses of RPC and the Extension Service Center
⑤ Strict enforcement of crop rotation
⑥ Increase of soil organic matter and soil fertility by annual grass cultivation
⑦ Trials of cultivation technologies on different crops, method of drainage in fields etc..

(5) Mechanization for Grass Cultivation

It is necessary to mechanize in hay making of annual grass. However, there is no experience of hay making of grass in Aq Qala District. Therefore, the farmers do not have machinery for cultivation and hay making of grass.

Annual grass of first harvest in December is used to own livestock as green fodder, because it is rainy in winter and difficult to make hay. Grass of harvest in April to August is used as hay. In hay-making of grass, it takes 3 days to work of cutting of grass, raking for drying in the sun, collecting dried grass to the raw, baling to hay and transport to storehouse. The required machinery is shown in Table 6.3.9.

Table 6.3.6 Cultivation Method and Production Cost (wheat under irrigation, for Tazeh Abad)

Farm Materials

Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Sterilizing seeds	kg	180	11,300	203,400	
Fertilizer (phosfate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	times	4	62,500	250,000	1st; 80,000 Rls./ha, 2nd: 70,000 Rls./ha, 3rd; 50,000 Rls.
Pesticide	kg	2	14,000	28,000	Sevine
Herbicide	liter & kg	1 lit. + 15 g	79,400	79,400	Topic, grand Star
Insurance due				8,000	
Repayment of debts	ha	1	102,000	51,000	debt; construction of canal and drains. Allotting amount to 2 crops during a year.

Farm Works

Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (drill)		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		2	15,000	30,000	
Irrigation water charge		2	30,000	60,000	
Spraying pesticide		2	25,000	50,000	
Harvesting (with combine)		1	200,000	200,000	
Transporting products to market				35,000	
Total cost				1,470,300	
Income by sale of straw				360,000	200packs, each 1,800 Rls
Net production cost				1,110,300	

When yield is 4,000 kg/ha, and producer's price is 1,050 Rls/kg, the gross income per ha is 4,200,000 Rls. Therefore, the net income is 3,089,700 Rls/ha.

The gross income, production cost and the net income per kg are 1,050 Rls/kg, 228 Rls/kg and 822 Rls/kg, respectively.

The net income is about 78 % of the gross income, and about 361 % of the production cost.

Table 6.3.7 Cultivation Method and Production Cost (Cotton under irrigation, for Tazeh Abad)

Farm Materials

Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seed	kg	40	2050	82000	
Fertilizer (phosfate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	150	315	4,725	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	times	3	110,000	330,000	1st; 130,000 Rls./ha, 2nd: 100,000 Rls./ha, 3rd; 100,000 Rls.
Pesticide	kg	12	20,000	240,000	
Herbicide	liter	2.5		28,500	Sonalan
Insurance due				14,000	
Repayment of debts	ha	0.5	102,000	51,000	debt; construction of canal and drains. Allotting amount to 2 crops during a year.

Farm Works

Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing	ha	1.5	75,000	112,500	
Disc harrow	ha	4	37,500	150,000	
Sowing (drill)	ha	1	40,000	40,000	
Making drain	ha	1	30,000	30,000	
Pesticide	ha	1	30,000	30,000	
Transporting seeds and fertilizer	ha	1	12,000	12,000	
Fertilization	ha	2	15,000	30,000	
Weeding	ha		-	559,000	Manual (33 personsx13,000
Cultivator	ha			25,000	| Rls), car(8,000Rls)
Spraying pesticide	ha	4	30,000	120,000	| and oversee worker (50,000 Rls)
Irrigation		4	30,000	240,000	Manual (4 times x 2 persons)
Harvesting (with combine)	ha			945,000	Manual (labor 57 x 15,000Rls,
Transporting products to market	kg	2,200	40	88,000	| oversee worker 3 x 25,000Rls, car
Other cost				295,400	| 8,000Rls
Profit of fund				271,380	
profit of management				647,353	
Other cost				295,400	
Total cost				4,870,258	

Note :

When yield is 2,000 kg/ha, and producer's price is 2,850 Rls/kg, the gross income poer ha is 5,700,000 Rls. Therefore, the net income is 829,742 Rls/ha.

The gross income, production cost and the net income per kg are 2,850 Rls/kg, 2,435 Rls/kg and 415 Rls/kg, respectively.

The net income is about 15 % of the gross income, and about 17 % of the production cost.

Table 6.3.8 Cultivation Method and Production Cost (Annual Grass under Irrigation/for Tazeh Abad)

Farm Materials					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seeds	kg	20	3,500	70,000	Grass; Setaria (glauca)
Fertilizer (phosfate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	times	3	83,333	250,000	1st; 80,000 Rls./ha, 2nd: 70,000 Rls./ha, 3rd; 100,000 Rls.
Insurance due				8,000	
Repayment of debts	ha	1	102,000	51,000	Debt; construction of canal and drains. Allotting amount to 2 crops during a year.
Farm Works					
Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (broadcast seeding))		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		3	15,000	45,000	
Irrigation water charge		2	30,000	60,000	
Harvesting		3 times x 5 processes	20,000	300,000	Mower, rake, baler, trailer (5 processes) and storage
Transporting products		3	35,000	105,000	Delivery at home gate
Total cost				1,364,500	

When total hay yield is 4/ha, and producer's price is 825 Rls/kg, the gross income is 3,300,000 Rls. The net income is 1,935,500 Rls/ha.
The gross income, production cost and the net income per kg are 825 Rls/kg, 341 Rls/kg and 484 Rls/kg, respectively.
The net income is about 59 % of the gross income, and about 142 % of the production cost.

Table 6.3.9 Machinery for Cultivation of Pasture Plants (2002)

Machinery	Type	Unit Price (Million Rls.)	Remarks
Tractor	75 Ps, Massy Ferguson	57.5	Included transporting fee to Gorgan, Tabriz Tractor Manufacture
	75 Ps, Massy Ferguson	57.5	Included transporting fee to Gorgan, Tabriz Tractor Manufacture
Baler	John Deer,	38.5	Arak Combine Manufacture
Disc harrow	3-wheeled and with 32 blade	8.5	Made in Golestan Province
Trailer	Loading capacity; 5 tons, unloading 2 sides, 4 wheel	12.5	Iran Tractor Manufacture
Broadcaster	for spreading seeds and fertilizer, centrifugal spreading	2.5	Made in Golestan Province
Seeder	for spreading seeds and fertilizer, wheel type	6.5	Made in Golestan Province
Rake	linear	3.2	
Mower	Disc-type	3.2	
Sum		189.9	

Source: Golestan Jihad-e-Agriculture Organization

One-set of machinery for grass cultivation is composed of two tractors (75 PS), a baler, a disc harrow, a trailer, a broadcaster, a seeder, a rake and a mower, and the price of one-set machinery is about 190 million Rls. Besides, the one-set machinery can cover the cultivation of grass and hay making of about 70 ha.

It is proposed to organize the joint ownership group, and each group is organized with farmers, which are about 70 ha of grass, that is to say, 280 ha of their owned land in total and belong to the same canal as possible. Each group carries out cooperative purchases the machinery by loan, cooperative management of the farm woks of grass cultivation, and cooperative shipping.

As a result, cost of hay decreases and cost of mechanization can be reduced. The cooperative use of machinery for hay making will become the trigger to the cooperative mechanization of other crops.

(6) Plastic green house

As mentioned above, the proposed integrated farming model is composed of the crop production with crop rotation, the hybrid cow farming of 10 heads, and cucumber production in plastic green house for the farmers of small-scale farming. The objectives of the plan of cucumber production in plastic green house are increase of agricultural income of the farmers of small-scale farming and effective use of irrigation water.

In the development plan, we propose that only twenty plastic green houses are constructed in the project area (Tazeh Abad), because there are twenty green houses in Golestan Province in total at present, and it is necessary to decrease of repercussion of market. According to the plan of the Agriculture Research Station, production, profit, cost and repayment of loan to bank in cucumber cultivation for a plastic green house of 500 m^2. The plan was adopted as the agricultural development model. That is to say, the integrated farming model includes the plan of cucumber production in plastic green house for the farmers of small-scale farming.

When farmer constructs a plastic green house with loan of the bank, farmer must apply to the Golestan Agriculture Organization for permission to construct to go well the farming by guidance of the Organization. Over 100 cases have been permitted by the Organization during the last five years, but only 20 green houses are working. The reason of failure of green house cultivation was that farmer could not repay the borrowed loan. The conditions of loan are repayment within 5 years and 15% of annual interest rate.

In 20 plastic green houses, cucumber is only cultivated, because techniques of cultivation are easy and producer’s price is relatively high. In this plan, however, farmers can select various profitable vegetables with acquisition of cultivation techniques.

Outline of the plan is as follows;

1） According to the plan, four houses of 500 m^2 each are constructed and managed to decrease costs. Therefore, all data are described on four green houses (2,000 m^2).

2） Investment: construction of house (4 houses of 500 m^2 each), water tank (1), generator for emergency (1), heater (4), irrigation facilities (2000m^2), lighting facilities (1), etc. Investment for fixed assets is 118.511 million Rls.

3） Production of cucumber in green house is carried out two times a year as shown in Fig. 6.3.1.

4） Annual running cost is about 31 million Rls. in total of 4 houses. That in one house of 500 m^2 is 7.8 million Rls.

5） Average yield of cucumber included 2 times cultivation is 20kg per m^2. Therefore, annual production in 500 m^2 of green house is 10 tons.

6） Gross income in 500 m^2 of green house is 15 million Rls.

7） Amount of annual repayment of loan is about 18 million Rls. in total of 4 houses. That in one house of 500 m^2 is 4.5 million Rls. in case of 10 years of term of repayment. In case of 5 years of term of repayment, annual repayment of loan is about 27 million Rls. in total of 4 houses. That in one house of 500 m^2 is 6.8 million Rls.

8） Net income except repayment of loan is about 29 million Rls. in total of 4 houses and for each house of 500 m^2, the net income is 7.25 million Rls.

9） Net income during 10 years of repayment of loan is about 11 million Rls. in total of 4 houses in case of 10 years of repayment term, and about 7 million Rls. in total of 4 houses in case of 5 years of repayment term, respectively.

Therefore, the net income in one green house of 500 m^2 during 5 years or 10 years of repayment of loan is about 1.7 or 2.8 million Rls. After 5 years from commencement of the plan, the net income will become about 7.2 million Rls.

Table 6.3.9 Production, income and cost of cucumber cultivation in plastic green house

No.	Items	Unit price Rls	Quantity	Price Million Rls.	Remarks
1	Investment				
	1) Construction and facilities of green house				
	Frame pipe	25,000	4x500m2	50.000	
	Heater	5,000,000	4	20.000	
	Nentilator	400,000	4x2	3.200	
	Irrigation facilities	7,500	2,000m2	15.000	
	water tank	2,000,000	1	2.000	
	Plastic film	5,000,000	5,000m2	5.000	
	Generator	5,000,000	1	5.000	For emergency, 2 kw
	Guard and resting house	5,000,000	1	5.000	12 m2
	Others			5.280	
	Sum			**110.480**	

No.	Items	Unit price Rls	Quantity	Price Million Rls.	Remarks
2	Equipments and implements				
	Sprayer	3,000,000	1	3.000	
	Thermometer	70,000	4	0.280	
	Thermometer in soil	100,000	4	0.400	
	Hygrometer	7,000	4	0.280	
	Scissors with long grips	80,000	4	0.320	
	Scissors with short grips	20,000	4	0.080	
	Ordinary scissors	75,000	4	0.300	
	Hoe	20,000	4	0.080	
	Trowel	4,000	10	0.040	
	Handcart	150,000	2	0.300	
	Lighting facilities		1	2.000	
	Rake	7,000	4	0.028	
	Thermostat	40,000	4	0.160	
	Others			0.363	
	Sum			**7.631**	
3	Annual total cost				
	Depreciation of building			0.776	25 years
	Depreciation of facilities			0.490	15 years
	Running cost			23.330	
	Sum			**24.596**	
4	Running cost (2 times cultivation during a year)				
	Liquid fertilizer			0.400	40 liters
	Chemical fertilizer			0.200	Potassium, phosphate, urea
	Manure			0.200	
	String			0.240	
	Chemicals			0.500	
	Packing materials			3.000	
	Fuel	150 /liter		5.400	200 lit./day x 6 months
	Electricity			3.000	
	Shipping	15,000/ton		0.600	
	Wage of laborers			4.200	2 persons x 7 months
	Hybrid seeds			3.600	
	Plastic tubes for warm current of air			0.510	
	Supervisor for part-timers			2.000	
	Management cost			5.926	5% of fixed cost
	Other costs			1.489	
	Sum			**31.265**	
5	Balance				
	Total annual cash income (4 green house)	1,500 /kg		60.000	Average yield of cucumber included 2 times
	Total annual running cost			31.265	
	Net income			**28.735**	The net income of one house (500m2) is
6	Repayment of loan (in case of 10 years of term of repayment)				
	Payment in installments of the principal			9.898	Investment: fixed assets;118.511 million Rls.,
					Total loan (bank) ; 90% of total investment
	Interest on loan			7.621	
	Amount of annual repayment			**17.519**	In case of 5 years of term of repayment:
7	Net income during 10 years of repayment of loan			**11.216**	In case of 5 years of term of repayment:

Source: Golestan Jihad-e-Agriculture Organization, Agriculture Research Station, 2001

Note: The net income of 500m2 of plastic green house is 2.8 million Rls./year during 10 years of repayment of debt, and after payment off the debt, the net income of 500 m2 of plastic green house is 7.184 million Rls..

(6) Supporting Plans

In order to execute the proposed plan, supporting activities of RPC, Extension Service Center, Jihad-e-Agriculture Organization and various research organizations are indispensable for farmers.

1) Technical Aspects

Main required supports required are as follows;

a) Strengthening of staff of Jihad-e-Agriculture Organization and extension service center: Increase of staff of irrigation engineer, of cultivation technology of green house, of supervisor of mechanization, and of animal husbandry.

b) Execution of 'project of technological development research' to carry out the trials and to verify the integrated farming in Tazeh Abad Project Area.

c) Improvement of supply system of farmer materials in required period and at the optimum time.

d) Expansion of Government's guaranteed prices to other important crops; apply to hay of grass

e) Improvement of extension under condition of low literacy rate and religious custom. Increase of exhibition fields, meeting under participation of the clergyman, etc.

2) Marketing

a. Objectives

In order to increase farmers' income, it is required that the production should reach markets and be sold at the price that can create benefit for them. The markets of present products produced in Tazeh Abad Project Area are ensured. But there are some problems that should be solved as mentioned in section 6.1.2. Establishing a marketing section in RPC Pavand is proposed as one of the solutions for this in the RPC Pavand Strengthening Plan. Hereinafter, supply of the materials to agro-processing factories is proposed as one of the methods obtaining the markets for newly produced crops such as cucumber and peas, planned in 6.3 Basic Guidelines of the Agricultural Development Model.

b. Processing of Agricultural Products

In Golestan Province, there are three factories to produce pickles of cucumbers and caned peas. Both pickled cucumbers and canned peas are popular ingredients of home made Iranian dishes. Therefore, increase of demand on these foods can be expected with increase of population. One of the factories is located in Gorgan City, named "Kesht and

Sanat-e-Gorgan." The products produced in this factory have the most famous agro-processing foods' brand name in Iran, "1&1." The capacity of the factories is large and they could be the market of the cucumbers and peas newly produced in the project area. Moreover, a dried vegetable factory started to operate in the Study Area, June 2002. The management of this factory is not stabilized yet but this also can be one of the markets in the near future. The person in charge of marketing research working for RPC Pavand, as proposed in RPC Pavand Strengthening Plan, can negotiate with the factories mentioned above to supply the materials at reasonable price.

It is obvious that establishing a new factory in the project area can secure the market more than the supply of the materials to the factories and add value on the products. Nevertheless, it is difficult to set up a new factory under the present circumstances because of the following reasons:

- Factories (including agro-processing) should be constructed in the industrial area determined by government,
- At least 30% of total capital should be prepared from owned capital,
- The procedures of getting the permission from governmental agencies concerned such as Jihad-e-Agricultural Organization and Health and Medical Care Organization (Health and Hygiene Department), for establishing agro-processing factories and starting their operation are complex and it takes a lot of time,
- Huge amount of water is required to produce canned food,
- Competition with the other factories should be severe,
- To win the competition, the products must be under high quality control and it is tough,
- A person who has much experience of this field should be hired otherwise it will be easily bankrupted.

3) Agricultural Finance

a. Objectives

One of the serious problems of the RPC Pavand members is shortage of fund for farming. In other words, preparation of production cost for the next year is a very critical matter for all of them. RPC Pavand intermediates the loan from Agricultural Bank, and furthermore, there are also many branches of banks around Tazeh Abad Project Area. The problem of obtaining loans from banks is high interest rate and hard access if the farmer has no connection with the bank. Moreover, RPCs have the limitation of loan volume.To solve this problem, attribution of agricultural finance function to RPC Pavand is proposed in 6.5 RPC Strengthening Plan. Hereinafter, the other plan to obtain the fund is proposed.

b. Agricultural Credit System

RCO (Rural Cooperative Organization) is the other popular organization among the members of RPC Pavand. RCO is a public organization established for improving rural settlers' living standard through providing living necessaries, agricultural inputs, and collecting and shipping of agricultural products. One of its activities is to loan the members. This is intermediation between the members and Agricultural Bank as same as RPCs. The members have to pay back money to Agricultural Bank through the RCO after a harvest (in a year) at the interest rate of 4% or 16% per year. The RCO takes 1% per year of the service charge.

As mentioned above, RCO has already got accustomed to agricultural financing activities. Moreover, most of RCO has surplus and can afford to strengthen the present function. It means that there is a possibility for RCO to be a new loan provider with reasonably low interest rate through strengthening the present function. The plan is summarized as shown below.

a) Implementing agency	RCO
b) Project term	II Stages, 10 years
c) Contents in each Phase	Stage I Strengthening present agricultural finance activities (5 years) Stage II Independence from RCO as a financial organization (5 years)

Stage I: Strengthening of present agricultural finance activities

Even though most of RCO has surplus, some value of initial funds from other organizations should be prepared. They could be borrowed from Agricultural Bank or international financial organizations such as IFAD (International Fund for Agricultural Development) because Iran is a member country of IFAD. Expected available programs for the proposed plan in RPC Strengthening Plan and this plan will be 'Long-term on-farm investment' and 'Rural financial institutions'. The former one is that IFAD will support activities to help farmers invest in their farms, and the latter one is that it will support to self-sufficient and sustainable community-based rural financial institution. Additionally, it is necessary to hire the staff in charge for starting this activity.

Stage II: Independence from RCO as a financial organization

Agricultural financing activities of RCO basically are targeted on its members. At the beginning of the plan, it is approved but the agricultural financing sector should be independent from RCO for non-RCO members but the RPC members after stabilization of the management in Stage II. For proceeding this plan smoothly and effectively, the assistance of Agricultural Bank is strongly required through Jihad-e-Agricultural Organization.

6.3.3 Irrigation and Drainage Facilities Development Plan

(1) Design of the Irrigation and Drainage Facilities

1) Water Source Facility

It is indispensable to have concrete coordination and discussions based on the data and information on water balance among relevant agencies, sectors and locations along river drainage system, excluding the present intake system from Gorgan River.

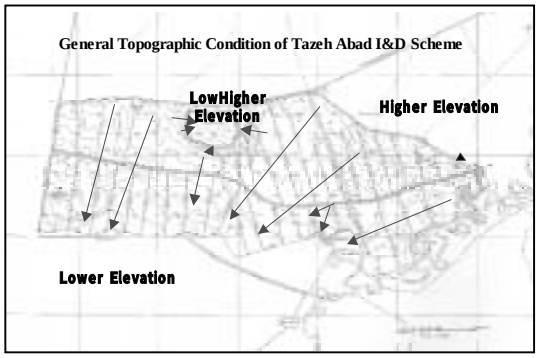
1. Utilization of the existing pump intake facility

None of the major constraints of the existing pump station, which was completed 4 years before, are not reported, excluding the suction of sediment. It will be required to set measures of river improvement, provision of de-silting chamber and intake chamber for avoiding the aspect.

2. De-silting pond

Both of the farmers and the cooperative are receiving the effects of the de-silting pond provided in downstream of the pump station, which was functioning from the last winter. No constraints and problems are reported until now.

3. Farm pond for irrigation in dry season



Presently a farm pond for irrigation in dry season is under construction in the central area of the scheme. Total area prepared for the facility is 170ha, area for the pond is 150ha and the total capacity of the storage is 4MCM. The objective of this pond is to serve irrigation water in dry season for 600ha farm area in the downstream area of the scheme. The pond is located at an elevation of 41.0m. The farmland in upstream of the scheme is in between elevation of 47 to 43.0m, and therefore pump station will be required to convey it to upstream area.

Besides, another idea of a new farm pond in the vicinity of the existing de-silting pond shall be examined, because it is said that about 30ha area is available for a new pond, if required. It is expected to obtain 1.35MCM under the condition of 30ha pond with an effective depth of 4.5m. It will be equivalent to irrigate 200ha per one season. Hence, for 4-year crop rotation, the farms can receive water once in 4-years and totally 800ha can be irrigated during the rotation.

2) Irrigation Facility

1. Main Irrigation Canal

The ‘Main Irrigation Canal’ mentioned in this report is the about 500m distance canal, which runs from the most upstream pump station to the first canal diversion, and connects with the de-silting pond.

Main irrigation canal is lined with concrete at the bottom and two side walls for the range from the intake pump station to the first diversion structure. It connects with the de-silting pond hence diversion to the pond and a structure of turn-off are the appurtenants of this canal. The condition of the canal is without any troubles and hence to be excluded from the planning in this study.

2. Secondary Irrigation Canal

‘Secondary canal’ in this report is the canals which run form the first diversion to two directions, one the ‘North Secondary Canal (NSC)’ and the other the ‘South Secondary Canal (SSC)’. The distance of NSC planned originally planned is 10,725m, of which 6,680m is already constructed in the far upstream side and the first 4,800m is lined with concrete. The remaining part is left as earthern canal. There are 6 diversions in this range, functioning without any trouble.In the downstream side, there is no canal for 4,050m length and hence about 360ha area has never received water through the system of the scheme even though they already joined the cooperative. It is expected to complete the construction the lining and and new provision of canal for the area as earlier as possible.

The total distance planned and constructed of the SSC (South Secondary Canal) is 10,690m. Only the most upstream 370m range is lined with concrete due to shortage of the implementation budget. It is obvious that water loss from the canal while flowing this 10km earth canal is high and the lining is indispensable to save the loss .

3. Tertiary Irrigation Canal

‘Tertiary Canal’ means the canals, which diverge from secondary canals to convey the irrigation water to the farmland. Most of the tertiary canals run from north to south, diverted from the secondary canals and delivering irrigation water to farm blocks. 19 canals with a total length of 32,610m of tertiary canals are planned but 6 canals with a total of 9,440m in the downstream side is never provided in the system of NSC. On the other hand, 17 canals with a total of 25,730m distance, 3 tertiary canals with 5,868m total length is never provided. All of the tertiary canals are planned as earth canal.

4. Design for Irrigation Related Facilities

This study will include the followed aspects as design for irrigation related facilities from the

view point of earlier realization of water delivery to 3,040ha farmland.

a) Secondary canal for the most downstream of NSC, including concrete lining
b) Canal lining for the existing earth canal portions of NSM and SSC
c) Diversions on secondary canals
d) Tertiary canal for the most downstream of the scheme, including concrete lining.
e) Canal lining for the existing earth canal portions
f) Diversions on tertiary canals

3) Drainage Facility

Drainage system in the scheme consisted of secondary drainage canal which receive drains from farmlands directly and main drainage canals which receive drains from the secondary canals.

1. Secondary Drainage Canal

Tertiary drainage canals are already functioning in the scheme placed along the tertiary irrigation canal. The interval of the drainage canal is about 400m or 500m. The most important task of the canal is to receive drains of leaching water from the farmlands and to keep the groundwater level lower. And the depth adapted is about 2.5m. Presently, most of the farmers are complaining against the salt hazard, and the drainage density is not sufficient. Besides, the plan of drainage provision shall be applied for the area without any irrigation and drainage systems.

2. Main drainage canal

The Scheme has two main drainage canals. One is covering the area which the NSC is supplying irrigation water system. There are two canals of which one is North Main Drainage Canal running along with SSC which receive the drainage from the northern part of the project area and the other one is South Main Drainage Canal receiving the drainage from the southern part of the project area. Both of them connect to Caspian Sea. The depth of canal is set about 3.0m in order to receive the drainage after desalinization of soil in the project area. The canals do not have any problems and therefore, they are excluded from examining items.

3. New drainage canal

The existing secondary drainage canals are constructed with 400-500m intervals. Considering the salinization problem of the soils, the drainage density needs to be increased. Good results are reported from the neighboring similar projects where the intervals are set at 200-150m. Therefore, the installation of new drainage canals between existing ones is planned through setting up a standard at 200m intervals.

There are three new drainage canals plans. The first plan is installation of mole drain without

reducing farmland. However, the percentage of clay in the subsoil layer must be more than 35% and therefore it may be a problem in theTazeh Abad project area. The second plan can be installation of open canal flowing in the existing secondary drainage canals. This is the plan of installation of open canal based on the boundary of the landholding in the farm block. This plan is defined as an individual facility of farmers in Iran and total construction cost will be paid by the farmers. Moreover, decreasing area of the farmland will be large if the depth of the canals is set as same as the secondary canals. The third plan is installation of pipe drain running parallel with existing canals. In this case, government and a farmer will share 80% and 20% of total construction cost respectively. In this case, the farmer's share of cost is small and the reduction of the farmland can be avoided.

4) Land consolidation

The farmland completing land leveling is only 100ha in the farmland of the project area at present. Land leveling of the area is required for the following reasons:

a) Promoting the equalization of distributing irrigation water in the field plots for basin irrigation,
b) Equal distribution of irrigation water functions as preventing salinization in the field plots,
c) Promoting rapid operation of irrigation,
d) Promoting efficient farming through smooth operation of agricultural machinery,
e) Meeting the condition of promoting furrow irrigation which is expected to be introduced after basin irrigation, and
f) Decreasing irrigation loss through increasing irrigation efficiency.

Based on the above recognitions, land leveling is gradually introduced in this project. Slope of field surface after land leveling is 2% instructed by Irrigation Organization.

5) Farm Road

There are farm roads in the scheme area combined with secondary drainage canal and tertiary irrigation canal. Dimension of the main road is 6.0m and travel way is 4.0m width. Feeder road along tertiary irrigation canal and secondary drainage canal is 4.0m of road width and 3.0m travel way width. All the roads are constructed with excavated soil of canal construction and without any pavement. There are many requests from farmers to improve it because of muddy condition in wet season. Hence even though the gravel pavement work is to be proposed in the plan, the implementation time is to be scheduled after completing irrigation and drainage related works.

(2) Irrigation and Drainage Facilities and Other Infrastructures to be Constructed

1) Division of the Project Area

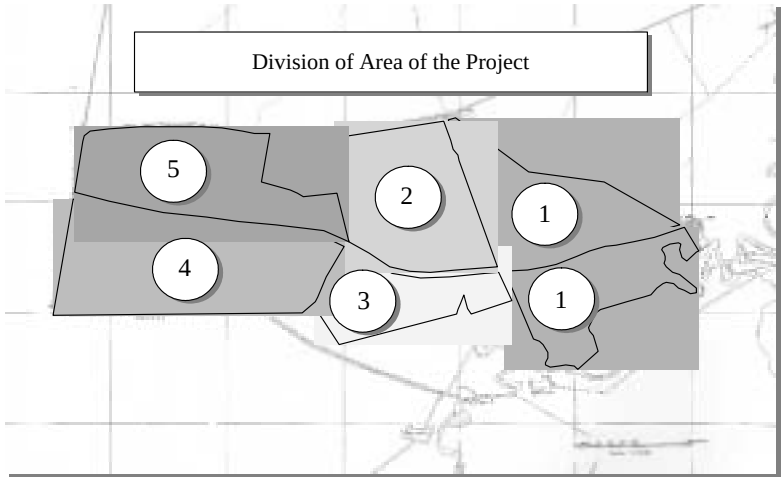
The facilities of irrigation and drainage to be constructed in the Tazah Abad Project are based on the following basic consideration:

It is obvious that all the development activities can not be carried out at the same time for various reasons including budget availability, etc. The phased implementation needs to be carried out based on a certain criteria from the viewpoint of actual condition of government and RPC in obtaining the budget.

At first the project area shall be divided into 5 areas as shown in the figure. The facilities to be constructed for irrigating all the 5 areas are mentioned below.

Division of Area of the Project

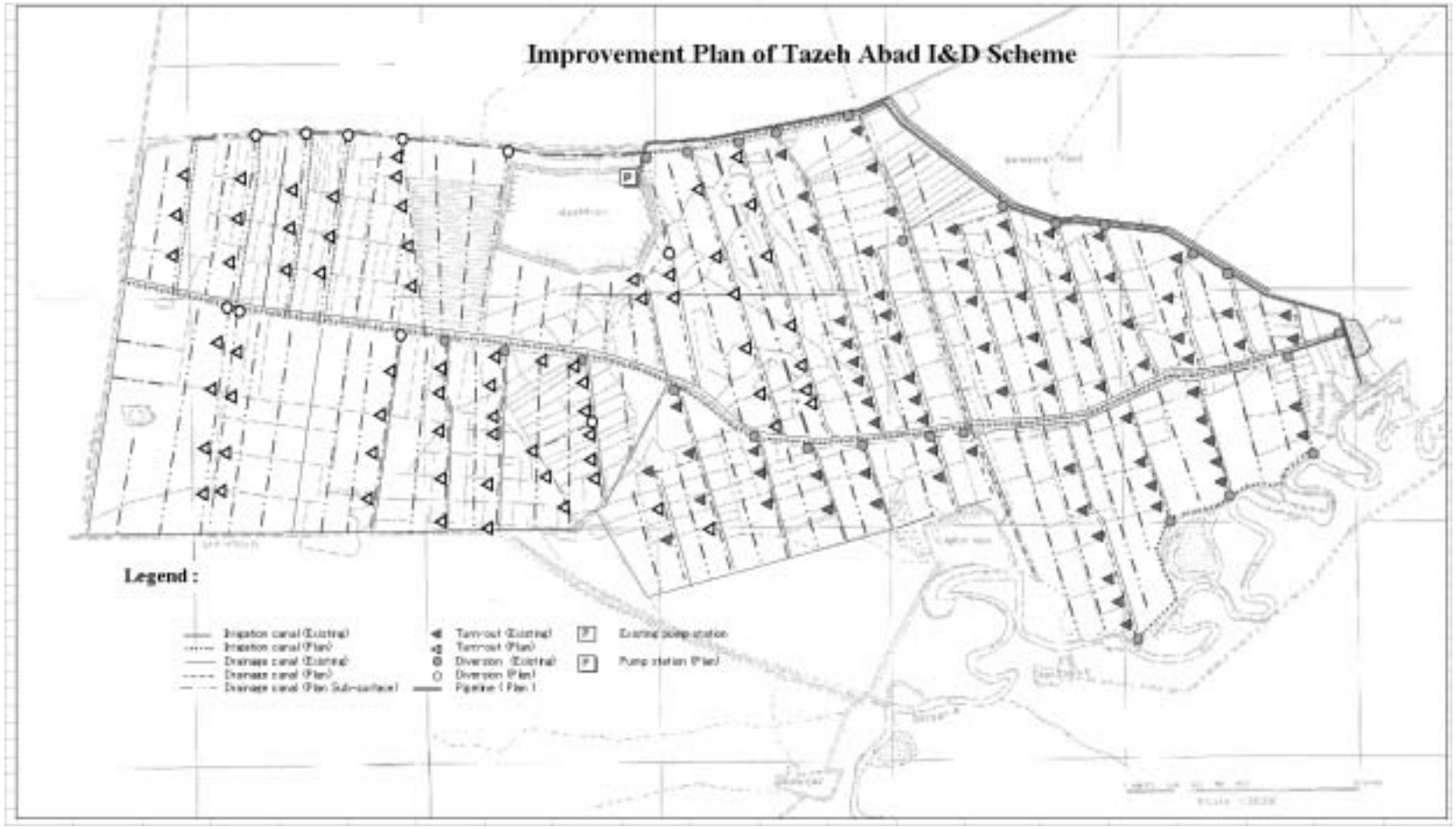
Area 1	Area 2	Area 3	Area 4	Area 5
822.00ha	575.00ha	246.00ha	739.00ha	658.00ha
The most nearest for water source and well developed area..	The area receive water from existing NMCanal.	The area receive water from SMCanal	The area can be irrigated farm pond water	The area should wait for completion of remaining NMCanal



2) Details of Facilities to be Constructed and Works to be Done

	Facilities	Quantity	
Farm Pond and Related Facilities			
1	To complete the Farm Pond		
2	New irrigation tertiary canal with concrete lining (For 4th Area)	5,898	m
3	Land acquisition for new farm pond provision	36	ha
4	New farm pond in 36ha area for 1.2MCM with 5m height embankment	1	set
5	Pump station at farm pond with necessary implements	1	set
6	New irrigation secondary canal with concrete lining (For 5th area)	4,068	m
7	New irrigation tertiary canal with concrete lining (For 5th Area)	9,424	m
Land leveling and Irrigation Facilities			
8	Farm block leveling with 0.2% slope (5 areas – 100 ha already completed)	2940	ha
9	Irrigation secondary canal lining, on both walls and basement (For 1st Area)	1,966	m
10	Irrigation secondary canal lining, on both walls and basement (For 2nd Area)	1,881	m
11	Irrigation secondary canal lining, on both walls and basement (For 3rd Area)	2,780	m
12	Irrigation secondary canal lining, on both walls and basement (For 4th Area)	4,847	m
13	Irrigation tertiary canal lining, on both walls and basement (For 1st Area)	17,322	m

	Facilities	Quantity	
14	Irrigation tertiary canal lining, on both walls and basement (For 2nd Area)	11,898	m
15	Irrigation tertiary canal lining, on both walls and basement (For 3rd Area)	5,966	m
16	Irrigation tertiary canal lining, on both walls and basement (For 4th Area)	6,542	m
17	Diversion structure on secondary canal to the tertiary (For 4th Area)	3	set
18	Diversion structure on secondary canal to the tertiary (For 5th Area)	5	set
19	New provision of turn-out to take water to the farm plot (For 2nd area)	17	set
20	New provision of turn-out to take water to the farm plot (For 3rd area)	2	set
21	New provision of turn-out to take water to the farm plot (For 4th area)	33	set
22	New provision of turn-out to take water to the farm plot (For 5th area)	17	set
Drainage Facilities			
23	Provision of secondary drainage canal (2nd area)	1,525	m
24	Provision of secondary drainage canal (4th area)	1,763	m
25	Provision of secondary drainage canal (5th area)	4,678	m
26	New open 2ndary lateral drainage between original ones (1st area).	16,066	m
27	New open 2ndary lateral drainage between original ones (2nd area).	10,503	m
28	New open 2ndary lateral drainage between original ones (3rd area).	5,565	m
29	New open 2ndary lateral drainage between original ones (4th area).	15,410	m
30	New open 2ndary lateral drainage between original ones (5th area).	6,562	m
Farm Roads			
31	Gravel pavement on the existing farm road, ROW 6m type (1st area)	393	m
32	Gravel pavement on the existing farm road, ROW 6m type (2nd area)	376	m
33	Gravel pavement on the existing farm road, ROW 6m type (3rd area)	556	m
34	Gravel pavement on the existing farm road, ROW 6m type (4th area)	969	m
35	Gravel pavement on the existing farm road, ROW 4m type (1st area)	17,322	m
36	Gravel pavement on the existing farm road, ROW 4m type (2nd area)	11,898	m
37	Gravel pavement on the existing farm road, ROW 4m type (3rd area)	5,966	m
38	Gravel pavement on the existing farm road, ROW 4m type (4th area)	6,542	m


Improvement Plan of Tazeh Abad I&D Scheme
Legend :
Irrigation canal (Existing)
Irrigation canal (Plan)
Drainage canal (Existing)
Drainage canal (Plan)
Drainage canal (Plan Sub-surface)
Turn-out (Existing)
Turn-out (Plan)
Diversion (Existing)
Diversion (Plan)
Pipeline (Plan)
Existing pump station
Pump station (Plan)

(4) Implementation Schedule

The implementation period of the Project construction works is set as 58 months in total consisting of the following:

1. Preparatory and Detailed Design Phase - 6 months
2. Construction Phase – 52 months

During the Preparatory and Detailed Design Phase, the topographic survey and geological investigation of the farm pond site, detailed design work are to be performed.

During the Construction Phase, the acquisition of land for the proposed structures, the construction works of the Project facilities, procurement of operation/maintenance (O/M) equipment, etc. are to be conducted.

1) Preparatory and Detailed Design Phase

During the Preparatory and Detailed Design Phase, all the preparatory works and the detailed design of the required facilities are to be completed. The review of the design only is required for some of the Project facilities the design of which has already been finished by Golestan J.A.O. However, some modifications or changes are proposed for some of the Project facilities/structures. For such facilities/structures, redesigning of them based on the results of the detailed topographic-survey of the respective sites and/or geological investigation at the sites to be conducted newly is definitely necessary.

2) Construction Phase

1. Land Acquisition

Prior to the commencement of the construction works of the Project, the land required for the Project facility, mainly for the second farm pond, shall be acquired by Paivand RPC which is the owner of the Project.

2. Implementation of Construction Works

The contractor for the construction of facilities shall be selected by tendering, whuch shall be conducted on the basis of the Open Competitive Bidding (OCB). In order to achieve the expected objectives of the Project as soon as possible, the construction works shall be shortened as much as possible by overlapping the respective works in due consideration of the anticipated inconvenience by overlapping of the construction works. In preparing the proposed construction schedule, the phasing of the construction works by focusing the completed section of the Main Canal and almost completed main intake pump station is also considered in order to facilitate the production of crops under irrigation. The proposed general construction schedule is as shown on the figure below.

Implementation Schedule of the Facilities to be Constructed

Facilities	Quantity	1st year	2nd year	3rd year	4th year	5th year
Farm Pond and Related Facilities						
1 To complete 4MCM farm pond	4 mcm					
2 New irrigation tertiary canal with concrete lining (For 4th Area)	5,898 m					
3 Land acquisition for new farm pond provision	36 ha					
4 New farm pond in 36ha area for 1.2MCM with 5m height embankment	1 set					
5 Pump station at farm pond with necessary implements	1 set					
6 New irrigation secondary canal with concrete lining . (For 5th area)	4,068 m					
7 New irrigation tertiary canal with concrete lining (For 5th Area)	9,424 m					
Land Leveling and Irrigation Facilities						
8 Farm block leveling with 0.2% slope (5 areas – 100 ha already completed)	722 ha					
9 Irrigation secondary canal lining, on both walls and basement (For 1st Area)	1,966 m					
10 Irrigation secondary canal lining, on both walls and basement (For 2nd Area)	1,881 m					
11 Irrigation secondary canal lining, on both walls and basement (For 3rd Area)	2,780 m					
12 Irrigation secondary canal lining, on both walls and basement (For 4th Area)	4,847 m					
13 Irrigation tertiary canal lining, on both walls and basement (For 1st Area)	17,322 m					
14 Irrigation tertiary canal lining, on both walls and basement (For 2nd Area)	11,898 m					
15 Irrigation tertiary canal lining, on both walls and basement (For 3rd Area)	5,966 m					
16 Irrigation tertiary canal lining, on both walls and basement (For 4th Area)	6,542 m					
17 Diversion structure on secondary canal to the tertiary. (For 4th Area)	3 set					
18 Diversion structure on secondary canal to the tertiary. (For 5th Area)	5 set					
19 New provision of turn-out to take water to the farm plot (2nd area)	17 set					
20 New provision of turn-out to take water to the farm plot (3rd area)	2 set					
21 New provision of turn-out to take water to the farm plot (4th area)	33 set					
22 New provision of turn-out to take water to the farm plot (5th area)	17 set					
Drainage Facilities						
23 Provision of secondary drainage canal (2nd area)	1,525 m					
24 Provision of secondary drainagecanal (4th area)	1,763 m					
25 Provision of secondary drainagecanal (5th area)	4,678 m					
26 New open 2ndary lateral drainage between original ones (1st area)	16,066 m					
27 New open 2ndary lateral drainage between original ones (2nd area)	10,503 m					
28 New open 2ndary lateral drainage between original ones (3rd area)	5,565 m					
29 New open 2ndary lateral drainage between original ones (4th area)	15,410 m					
30 New open 2ndary lateral drainage between original ones (5th area)	6,562 m					
Farm Roads						
31 Gravel pavement on the existing farm road, ROW 6m type (1st area)	393 m					
32 Gravel pavement on the existing farm road, ROW 6m type (2nd area)	376 m					
33 Gravel pavement on the existing farm road, ROW 6m type (3rd area)	556 m					
34 Gravel pavement on the existing farm road, ROW 6m type (4th area)	969 m					
35 Gravel pavement on the existing farm road, ROW 4m type (1st area)	17,322 m					
36 Gravel pavement on the existing farm road, ROW 4m type (2nd area)	11,898 m					
37 Gravel pavement on the existing farm road, ROW 4m type (3rd area)	5,966 m					
38 Gravel pavement on the existing farm road, ROW 4m type (4th area)	6,542 m					

(5) Cost of Irrigation and Drainage Facilities

1) Conditions

The cost is estimated base on the following conditions:

a. The basic cost such as labor cost, material cost and equipment cost are based on the unit costs adopted by the Department of Soil & Water, Golestan J.A.O;
b. The prices of domestic materials are based on those including transportation of them to the construction sites ;
c. The construction costs are estimated with only local component. The unit costs for respective work items consist of direct cost and indirect cost, and the indirect cost is set

as 33% of the direct cost in accordance with the regulation of the D.S.W ;

d. The exchange rate used is US$ 1.00 = Iranian Rial 8,000 as of October 2002; and

e. The physical contingency is set as 10% of the construction cost and other costs. The economic contingency is set as 3% per annum.

2) Construction Cost

The construction cost is estimated with the local portion only. The annual disbursement of the construction cost is determined based on the proposed schedule of the construction works.

The total construction cost is estimated to be 21,341.6 $x10^6$ Rials as shown in the table below:

Tentative Work Quantity for I&D Improvement for Tazeh Abad Scheme

	Work Item	Quantity	Unit cost	Cost x million Rials	Cost (Govt) x million Rials	Cost (Farmers) x million Rials
1	New irrigation secondary canal with concrete lining . (For 5th area)	4,068 m	Rls 35,000,000 / 100 m	Rls 1,423.80	Rls 1,139.04	Rls 284.76
2	New irrigation tertiary canal with concrete lining	15,322 m	Rls 25,000,000 / 100 m	Rls 3,830.50	Rls 3,064.40	Rls 766.10
3	Irrigation secondary canal lining, on both walls and basement (For 1st Area)	11,474 m	Rls 2,500,000 / 100 m	Rls 286.85	Rls 229.48	Rls 57.37
4	Irrigation tertiary canal lining, on both walls and basement	41,728 m	Rls 1,500,000 / 100 m	Rls 625.92	Rls 500.74	Rls 125.18
5	Diversion structure on secondary canal to the tertiary.	8 set	Rls 4,000,000 / set	Rls 32.00	Rls 25.60	Rls 6.40
6	Water diversion structure on tertiary, includes diversion gate to the tertiary. 2nd area	2 set	Rls 2,500,000 / set	Rls 5.00	Rls 4.00	Rls 1.00
7	New provision of turn-out to take water to the farm plot	69 set	Rls 1,200,000 / set	Rls 82.80	Rls 0.00	Rls 82.80
8	Provision of secondary drainagecanal	7,966 m	Rls 5,500,000 / 100 m	Rls 438.13	Rls 350.50	Rls 87.63
9	New open 2ndary lateral drainage between original ones	54,106 m	Rls 6,000,000 / 100 m	Rls 3,246.36	Rls 2,597.09	Rls 649.27
10	Gravel pavement on the existing farm road, ROW 6m type	2,295 m	Rls 3,000,000 / 100 m	Rls 68.85	Rls 55.08	Rls 13.77
11	Gravel pavement on the existing farm road, ROW 4m type	41,728 m	Rls 1,875,000 / 100 m	Rls 782.40	Rls 625.92	Rls 156.48
12	Pump station at farm pond with necessary implements	1 set	Rls 186,000,000 /set	Rls 186.00	Rls 186.00	Rls 0.00
13	Farm block leveling with 0.2% slope	2,939 ha	Rls 3,000,000 / ha	Rls 8,817.00	Rls 7,053.60	Rls 1,763.40
14	Land acquisition for new farm pond provision	36 ha	Rls 25,000,000 / ha	Rls 900.00	Rls 0.00	Rls 900.00
15	New farm pond in 36ha area for 1.2MCM with 5m height embankment	1 set	Rls 616,000,000 /set	Rls 616.00	Rls 492.80	Rls 123.20
	Grand Total (x million Rials)			Rls 21,341.61	Rls 16,324.25	Rls 5,017.36
	unit cost per ha (x million Rials/ ha) as reference			Rls 7.02	Rls 5.37	Rls 1.65

3) Land Acquisition Cost

The acquisition cost of land for the second farm pond is estimated to be 900,000x10^3 Rials and in total and allotted for the construction cost as shown in the above table.

4) Administration Cost

The administration cost necessary for the Project Office includes procurement of office supplies, payment to the office staff, general expenses, etc. The annual administration cost is estimated as 62.4 million Rials /year and allotted local portion.

5) Consulting Services Cost

The cost for the provision of the consulting services is estimated as 225.9 x 10^6 Rials.

6) Total Cost

As a result of the above, the total cost is estimated as 24,581.7 x 10^6 Rials as shown in the table. The disbursement of the cost is to be made in 5 years. The proportions of the disbursement for each year are 30.2% for the first year, 31.6% for the second, 33.5% for the third, 1.8% for the forth and 2.9% for the fifth.

Summary of the Project Cost for Tazeh Abad I&D Project

unit : million rials

Description	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
1 Construction Works	6,434.6	6,814.7	7,236.0	303.6	552.7	21,341.6
2 Administration	62.4	62.4	62.4	62.4	62.4	312.0
3 Consulting Services	104.3	38.4	38.4	25.6	19.2	225.9
Sub-total (1-3)	6,601.3	6,915.5	7,336.8	391.6	634.3	21,879.5
4 Physical Contingency (7%)	462.1	484.1	513.6	27.4	44.4	1,531.6
Sub-total (1-4)	7,063.4	7,399.6	7,850.4	419.0	678.7	23,411.1
5 Economic Contingency (5 %)	353.2	370.0	392.5	21.0	33.9	1,170.6
Total (1-5)	7,416.6	7,769.6	8,242.9	440.0	712.6	24,581.7
Proportion of disbursement (%)	30.2	31.6	33.5	1.8	2.9	100.0
Progress for irrigable area	1,400.0	1,646.0	2,014.0	2,382.0	3,040.0	

(6) Operation and Maintenance

Paivand Agricultural Cooperative (Paivand RPC) shall be responsible for all of the operation and maintenance (O/M) activities of the irrigation facilities in the Tazeh Abad Irrigation Scheme. Besides, that it is obvious that the Golestan of Jihad-E-Agricutural Organization has to manage the tasks to encourage and assist the RPC and its members to improve the control system step by step with the improvement of the farming technology and the financial level of the farmers involved in the Project. It is recommended that the duties and responsibilities of the RPC for the O/M of the Project facilities shall be transferred item by item step by step to the cooperative.

The main operation and maintenance activities are as follows:

- Operation and maintenance of the main Project ;
- Maintenance of the canal networks including the O/M roads and other farm roads;
- Instruction to the members in charge on water delivery and O/M of the canals; and
- Collection of water charge from the users as doing presently.

Required staff members should be assigned for carrying out the above mentioned activities effectively.

Annual O/M Cost

Item	Amount (Rials)
1. Salary	38,400,000
2. Cost of Spare Parts	45,978,000
3. Other Office Running Cost	3,072,000
4. Electricity for Pumps Operartion	8,600,000
Total	96,050,000

The annual operation and maintenance cost is 96,050,000 Rials as shown in the following table. Furthermore, some of the mechanical items and heavy equipment shall be renewed due to their shorter durability than the Project life. Sixty percent (60%) of the initial cost of pump equipment, pipes and gates or 504 x10^3 Rials as the replacement in 15 years after new installation is estimated and used for the evaluation of the Project.

6.3.4 RPC Pavand Strengthening Plan

(1) Objectives of RPC Pavand Strengthening Plan

RPC Pavand is established to contribute to increasing members' income through stable production and reduction of the production cost for poverty alleviation. RPC Pavand has a good President and tries to meet various demands from the members under the constraints such as shortage of water, delay of infrastructure's construction, limitation of available finance, shortage of staff and agricultural machinery and so on. In order to overcome these constraints and aim at more effective activities, the RPC should enhance present functions and add new functions. Moreover, the strengthened RPC Pavand should be corresponding to 'Agricultural Development Model' and 'Irrigation and Drainage Facilities Development Plan' proposed in 6.3 and 6.4 respectively. Implementing agencies, terms, and contents of RPC Pavand Strengthening Plan in each Stage is summarized in the table below.

a) Implementing agency	RPC Pavand and its members
b) Project term	III Stages, 15 years
c) Contents of RPC Pavand Strengthening Plan in each Stage	Stage I Enhancing present functions (5 years) Stage II Adding new functions (5 years) Stage III Established with the enhanced and added functions (5 years)

(2) Organization Functions

Five functions are enhanced and two functions are newly added to RPC Pavand. Former ones are 1) Policy making, 2) Supply of agricultural inputs, 3) Collective gathering and forwarding activities, 4) Extension service and 5) Water distribution. Latter ones are 1) Agricultural finance and 2) Guiding and supervising joint ownership group of agricultural machinery. The activities to enhance and add the functions are mainly implemented by the RPC staff and its members but the support and advice from government is surely required to succeed in this plan. Then, RPC Pavand could be a model RPC in Golestan Province. The functions are described as follows.

1) Present enhancing functions

1. Policy making

At present, the RPC decides the detailed strategies following the basic policy decided by Jihad-e-Agricultural Organization through the meetings with the RPC President and the executive board selected from the members. The RPC is expected to enable to make all policies concerned in 5 years, in other words, until finishing Stage I. For that purpose, it is required to establish more tight relationship between RPC technical and administrative staff including RPC President and the members, and to empower the members to make them join more in the policy making process. If necessary, participatory planning methods such as PLA (Participatory Learning and Action) and PCM (Project Cycle Management) will be applied for

empowering the members to grasp the present problems and their solutions.

2. Supply of agricultural inputs

The subsidized agricultural inputs that RPCs can supply have limitation on volume and crops (now mainly for wheat). Moreover, its supply is not ensured. Therefore, besides this, collective purchase of agricultural inputs from a market through the RPC and its supply to the members are to be planned. The price will be the same as or very close to subsidized agricultural inputs. RPC must have more bargaining power than individual farmers and it is not difficult to achieve. In order to promote this function, a person in charge of collective purchasing should be hired by the RPC.

3. Collective gathering and forwarding activities

Enhancement of this function will be the pre-condition of starting agricultural finance planned in the Stage II proposed below. Obtaining of stable markets, reduction of transportation cost and the deal with better terms of trade are very important for improving the farm economy of the members. To enhance this function, a person in charge of marketing research will be hired and he/she will collect domestic and international market information on present and newly introduced products so as to find the best buyer.

4. Extension service

It is impossible for the present number of technical staff (2 persons including RPC President) to cover the whole area and give individual instructions to all of the members. The expectation of the extension service from the members is high. Therefore, it should be dealt by increasing technical staff (agronomy, animal husbandry, and irrigation and drainage). These technical staff should provide technical instruction and training to the formers on the following aspects on a regular basis.

a) Suitable farming technology for the project area
b) Technology of integrating agriculture and animal husbandry
c) Suitable irrigation and water management practices for the project area
d) Suitable drainage practices to solve the salinization and alkalinization problems of the region

5. Water distribution

Shortage of water is the most serious problem in this area. Required activities for more effective use and operation and maintenance of irrigation and drainage facilities by small water management groups are proposed in section 6.4.

2) Newly added functions

1. Agricultural finance

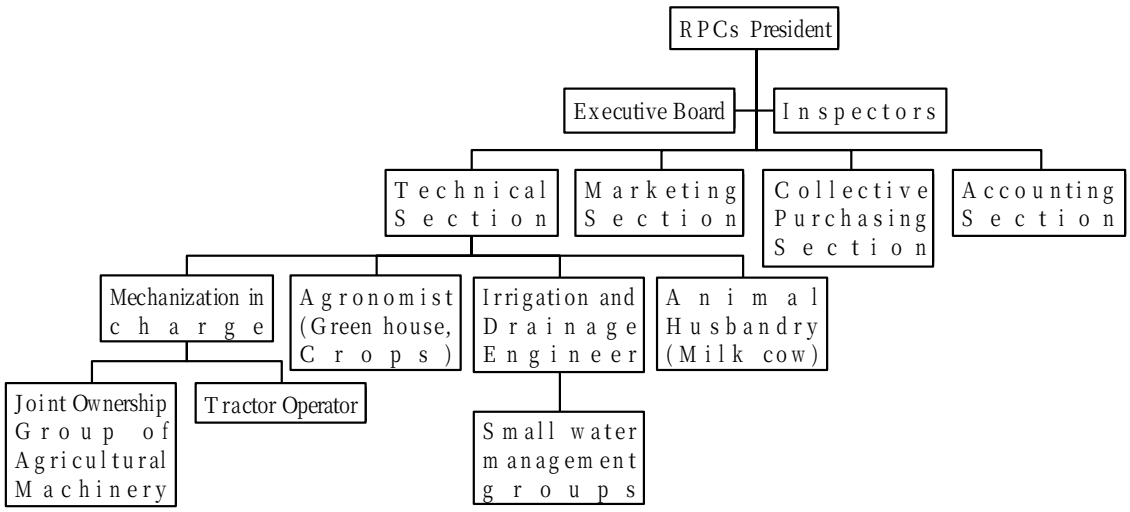
The other serious problem is shortage of fund for farming. In order to solve this problem, it is necessary for the RPC to attribute independent agricultural finance function. Initial funds could be borrowed from Agricultural Bank or international financial organizations such as IFAD (International Fund for Agricultural Development). Expected available programs of IFAD are explained in 6.7. If the internal funds are enough to start agricultural finance due to success of collective gathering and forwarding activities at this point (the beginning of Stage II), compulsory saving from the sales would start and use this for the lending activity. The disbursed loan should be at low interest rate, less than 10%/year. This loan will be repaid from the saving to ensure the repayment. Then, sustainable revolving fund could be established.

2. Guiding and supervising of joint ownership group of agricultural machinery

Joint ownership group of agricultural machinery will be formed corresponding to 'Agricultural Development Plan' in order to solve the shortage of machinery and to reduce the production cost. The RPC will guide and supervise these groups. More details are described in 6.3. Procedures of each step are shown in Fig.6.3.3.

(3) Structure of the Organization

The structure of the organization to carry out the procedures mentioned above is proposed as follows.



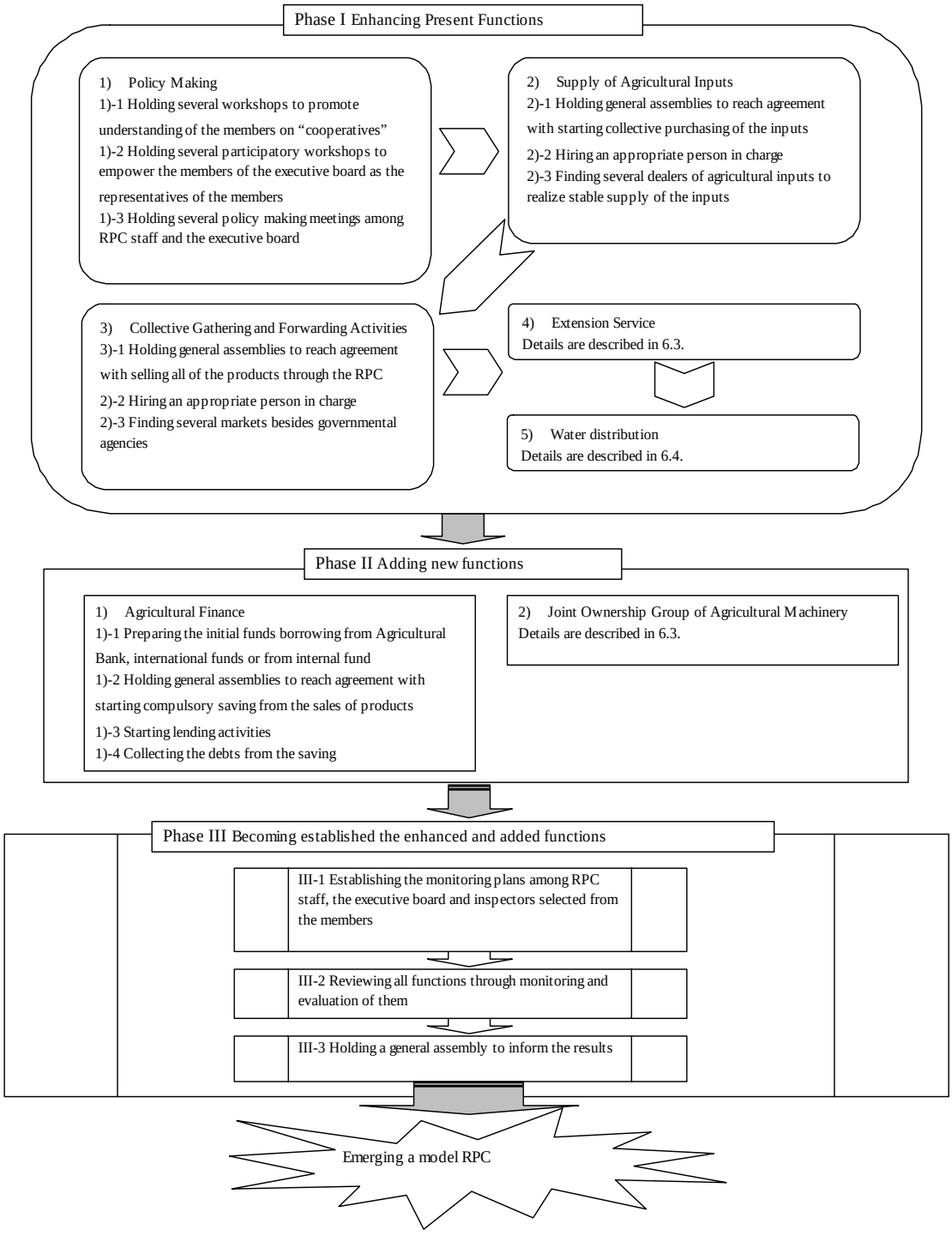


Fig. 6.3.3 Procedure of Strengthening RPC Pavand

(4) Governmental Assistance for “RPC Pavand Strengthening Plan”

The support and advice from government is required to succeed in this plan. For this purpose, Supporting Team for Assisting ‘RPC Pavand Strengthening Plan’ consisting of Departments of Cooperative Management, Extension, Crop and Breeding, Statistics, Animal Husbandry, Soil and Water Management in Jihad-e-Agricultural Organization and Agricultural Service Center should be organized. All of the departments and organization mentioned above will collaborate with each other, and give the support and advice to the section concerned in each phase when it is necessary.

Supporting agencies, terms, and contents of supporting ‘RPC Pavand Strengthening Plan’ in each phase are summarized as mentioned in the table shown below.

a) Supporting agencies	Supporting team for assisting “RPC Pavand Strengthening Plan” consisting of Departments of Cooperative Management, Extension, Crop and Breeding, Statistics, Animal Husbandry, Soil and Water Management in Jihad-e-Agricultural Organization and Agricultural Service Center
b) Project term	III Stages, 15 years
c) Contents of supporting “RPC Pavand Strengthening Plan” in each phase	STEP 0: Forming the supporting team for assisting “RPC Pavand Strengthening Plan” (including the training of participatory planning methods) STEP 1: Supporting to enhance the present functions STEP 2: Supporting to add the new functions STEP 3: Supporting to become established the enhanced and added functions (STEP 4: Starting a new supporting program)

(5) Cost Estimation for RPC Pavand Strengthening Plan

The estimated cost for implementing RPC Pavand Strengthening Plan is summarized in the table below. Total cost is estimated at Rls. 2,596 million for 15 years (3 phases).

Estimated Cost for RPC Pavand Strengthening Plan (Unit: Rls. Million)

Item Phase	Stage I	Stage II	Stage III	Total
Personnel (Person/year)	705 (141)	705 (141)	705 (141)	2,115
Equipment	198	-	-	198
Training (including workshops)	10	8	4	22
O&M	87	87	87	261
Total	1000	800	796	2596

6.4 Implementation Plan of the Project

6.4.1 Project Components and the Project Cost

(1) Project Components

In consideration of agriculture development plan, irrigation and drainage plan and RPC

strengthening plan, the major components of the Project are as follows:

1. Facilities for proposed farming system
2. Irrigation and drainage facilities
3. Strengthening of RPC Pavand

(2) Project Cost

The cost of each component of the project disbursed over 15 years period is mentioned below.

Description	Year									Total Cost (Million Rials)
	1	2	3	4	5	6	7	8 to 10	11 to 15	
1.Facilities for proposed farming system	6,200.8	189.9	379.8	16,873.9	379.8		10,434.0			34,458.2
2.Irrigation and drainage facilities	7,416.6	7,769.6	8,242.9	440.0	712.6					24,581.7
3.Strengthening of RPC Pavand	358.4	160.4	160.4	160.4	160.4	160.0	160.0	160.0	159.2	2,596.0
TOTAL	13,975.8	8,119.9	8,783.1	17,474.3	1,252.8	160.0	10,594.0	160.0	159.2	61,635.9

The total project cost is 61,635.9 Million Rials (approx. US$ 7.7 Million)

6.4.2 Project Implementation Schedule

The project implementation schedule is shown in the following table.

Project Implementation Schedule

Descriptions of Development Measures	1st year	2nd year	3rd year	4th year	5th year	6	7	8	9	10	11	12	13	14	15
1 Facilities for proposed farming system															
a Agricultural Machinery															
b Greenhouse															
c Hybrid Cows															
2 Irrigation and drainage facilities															
a Farm Pond and Related Facilities															
b Land Leveling															
c Irrigation Canals															
d Irrigation Structures															
e Drainage Canals															
f Farm Roads															
3 Strengthening of RPC Pavand															

6.4.3 Project Implementation Organization

(1) Project Implementation Agency

The Implementation Agency for the Project shall be Golestan J.A.O, on behalf of Paivand Farmers Cooperative (RPC), who shall be the Owner of the Project. It is obvious that some specialized assistances and coordination are indispensable to conduct construction works instead of the RPC to ensure the rational and smooth implementation. The Department of Soil & Water, Golestan J.A.O has sufficient capability for fulfilling its responsibilities in implementing the Project without any troubles. Besides, a full-time officer in charge shall be

assigned for the Project to manage all the management works for implementing the project.

(2) Project Implementation Method

The Project Implementation Agency shall execute the detailed design of the Project facilities, preparation of tender documents, tendering and tender evaluation, selection of the contractor, signing the contract and supervision of the construction works with the assistance of the Consultant to be contract prior to the commencement of the Project.

The Consultant shall be employed by the Implementation Agency for the technical services on the contract basis. The consulting services involve the detailed design work and evaluation of tender in the Detailed Design Phase and supervision of the construction works such as their workmanship, programming and safety control in the Construction Phase. The Consultant is also expected to undertake the technology transfer to members of the RPC, mainly for the aspects of O/M works.

The successful contractor(s) shall perform the construction works on the contract basis. The contractor(s) shall provide all the construction machinery required for the construction works. The materials necessary for the construction works shall be procured from domestic markets under the full responsibility of the contractors(s).

6.5 Project Evaluation

6.5.1 Principles for Project Evaluation

Tazeh Abad agricultural development project aimed to get rid of the present unstable agricultural production conditions and to increase farmers' income through the improvement of irrigation and drainage facilities and to practice sustainable agriculture farming. In the project evaluation of the feasibility study, the financial evaluation together with farm profit analysis shall be given priority over the economic evaluation due to the fact that this project does not require a great amount of public investment and the majority of the investment shall be borne by the farmers.

6.5.2 Evaluation Method

The NPV is to be calculated on the basis of annual cash flow of the net incremental benefits (benefits minus costs) to cover the whole project life, which is obtained as a consequence of the balance of agricultural farming and investment between "With" project situation and "Without" project situation.

In the project evaluation, the following parameters have been employed.

(1) The discount rate to be applied for calculating the NPV shall be as follows. Financial evaluation: 11% (Approximate average real interest rate, which is deflated from nominal interest rate taking into account of inflation rate). Economic evaluation :12% (To follow the International Financing Organization employed to similar development projects).

(2) The prices to be used for financial evaluation shall be those prevailed at the local markets for the middle quarter in 2002. In case of "With" project situation, the financial cost relevant to agricultural credit shall be contemplated. The economic evaluation shall be in accordance with the following principles.

- The export (import) parity prices of traded commodity (wheat) are estimated based on the border price. The border price consists of FOB price plus freight and insurance and inland transportation cost. The FOB price in Canada, the main importing country of wheat in Iran was US$0.136/kg and converted to Rls.1,076. This price is higher than the market price of Rls.1,050. Since the economic evaluation is only for reference, FOB price converted Rls.1,076 shall be employed. On the other hand, the prices for non-traded commodities shall be the same as the market prices.
- The imported construction machineries and some of agricultural machineries are calculated with shadow exchange rate between the average of the free market rate (US$1=Rls.8,007) and non-oil export rate (US$1=Rls.7,918). The conversion factor for the shadow exchange rate shall be 1.01.
- From market price, transfer items (financial cost for credit, taxes, irrigation charge, etc) shall

be deducted.

(3) The project life shall be 30 years, in consideration of the design, construction period and the economic lives of the irrigation and drainage facilities.

(4) Sensitivity analysis to find out how the project return would be affected under change of given variations of the project (10% rise in project costs, 10% decrease of farm-gate prices, 10% reduction of unit yield of agricultural produces) is carried out.

6.5.3 Financial and Economic Evaluation

(1) Project Benefit

The project benefit refers to the difference of net profit expected between 'with project' and 'without project' under the irrigation and drainage through the whole project life. The project benefit consists of quantifiable benefit such as increment of agricultural products and un-quantifiable benefit such as stabilized food supply, creation of employment opportunities and improvement of living standard of rural people. The quantifiable benefit is directly subjected to financial and economic evaluations, while un-quantifiable benefit is analyzed comprehensively for socio-economic effects.

1) Agricultural Products Benefit

In the Tazeh Abad area, at present 1,000 ha of farmland is counted as the irrigable area in an year. As a result of the execution of the project, a total of 3,040 ha can be irrigated after 5 years of construction. Accordingly, increased irrigated area will be cultivated by introduction of the rotation cropping including grass plating.

The estimated progress of the irrigable are is shown as bellow.

Year	Progress (ha)	Irrigable Area (ha)	Cropping Area (ha)
Present		1,000.0	1,000.0
1	400.0	1,000.0	1,000.0
2	246.0	1,400.0	1,400.0
3	368.0	1,646.0	1,646.0
4	368.0	2,014.0	2,014.0
5	658.0	2,382.0	2,382.0
6		3,040.0	3,040.0

The agricultural products benefit in the market price (financial price) is shown in the following table. By the implementation of the project, the benefit will be increases by 5.5 times as compared to the present conditions and the increment amount is Rls. 6,705 Million.

Unit：Million Rials

With Project	Without Project	Benefit
8,194.32	1,488.80	6,705.52

2) Benefit by Introduction of Hybrid Cow

Besides crop cultivation, 10 numbers of hybrid cow will be introduced to each farmer for stable farm management. The introduction will be done at 3 times.

Year	Nos. of Farmers	Accumulated
1	57 farmers (land tenure over 10ha) 16%	57
4	122 farmers (land tenure between 5ha to 10ha) 33%	179
7	188 farmers (land tenure less than 5ha) 51%	367

The benefit by introduction of hybrid cow for each farm household is shown below.

Unit：Million Rials

Benefit by Introduction	Present Benefit	Increment
24.524	2.980	21.544

3) Benefit by Introduction of Plastic Green House

To increase the agricultural income for the small-scale farmers (land tenure of less than 1 ha) and effective use of irrigation water, 20 units of plastic green houses will be introduced. Cucumber will be cultivated twice in the year. The benefit is shown in the following table.

Unit：Million Rials

Benefit per Unit	No. of units	Total
7.184	20	143.68

(2) Financial and Economic Cost

In pursuance with above-mentioned model for agricultural farming and capital investment, farm-gate price, production cost and cost of capital investment have been calculated for both financial and economic prices as mentioned below.

Item		Unit	Financial Price	Economic Price
Market price	Wheat	Rls/kg	1,050	1,076
	Rape	Rls/kg	2,050	2,050
	Grass	Rls/kg	825	825
	Pea	Rls/kg	1,870	1,870
	Cotton	Rls/kg	2,850	2,850
	Cucumber	Rls/kg	1,500	1,500
	Milk	Rls/l	1,450	1,450
Production cost	Wheat	Million Rls. /ha	1.110	0.999
	Rape	Million Rls. /ha	1.214	1.139
	Grass	Million Rls. /ha	1.365	1.064
	Pea	Million Rls. /ha	1.789	1.488
	Cotton	Million Rls. /ha	4.870	4.020
	Cucumber	Million Rls. /Unit	5.747	5.747
	Milk	Million Rls. /Farmer	24.596	23.330
Construction, machinery cost	Irrigation/ drainage	Million Rls. /ha	9.056	8.656
	Agricultural machineries	Million Rls. /ha	0.678	0.685
	Plastic green house	Million Rls. /House	29.567	29.567
	Building/equipment	Million Rls. /Farmer	29.567	29.567
	Cow	Million Rls. /Head	5.500	5.500

The project's return was calculated by using the above prices in the cash flow of the project life.

(3) Returns

The returns of financial prices and economic prices are shown as below.

Item	NPV	FIRR (%)
Returns based on the financial prices	(At discount rate of 12%) Million Rls.13,739	14.3
Returns based on the economic prices	(At discount rate of 11%) Million Rls.24,620	18.3

(4) Sensitive Analysis

Sensitivity analysis is carried out carried out with regard to the change of three variations: 1) 10% rise in project costs, 2)10% decrease of farm-gate prices and 3)10% reduction of unit yield of agricultural produces, and it is disclosed that the present project is more sensitive to change of unit yield of agricultural produces than other two variations.

Returns based on the financial prices

Item	NPV (At discount rate of 12%)	FIRR (%)
10% rise in project costs	Million Rls.16,291	14.8
10% decrease of farm-gate prices	Million Rls.7,539	12.9
10% reduction of unit yield	Million Rls.-4,541	10.7

Returns based on the economic prices

Item	NPV (At discount rate of 12%)	EIRR (%)
10% rise in project costs	Million Rls.26,904	18.7
10% decrease of farm-gate prices	Million Rls.20,825	16.2
10% reduction of unit yield	Million Rls.4,713	12.3

(5) Financial Analysis

The required project costs such as irrigation and improvement costs of drainage facilities, agricultural machineries procurement costs, costs for plastic green houses, and hybrid cows will be financed through the Pavand RPC of Tazeh Abad area.

1) Investment Costs and Repayment

The required amount for the project is summarized in the following table. In the improvement of the irrigation and drainage facilities, the Government will assist 80% of the construction costs of main, lateral and tertiary canals. All other costs related to the Project will be borne by the farmers.

Unit：Million Rials

Year	Irrigation/ drainage	Agricultural Machineries	Green houses	Hybrid cows	Total
1	2,001.9	949.5	591.3	4,660.0	8,202.7
2	2,097.2	189.9			2,287.1
3	2,224.9	379.8			2,604.7
4	118.8	189.9		16,684.0	16,992.7
5	192.3	379.8			572.1
6					
7				10,434.0	10,434.0
Total	6,635.1	2,088.9	591.3	31,778.0	41,093.3

2) Repayment period and Interest

The repayment is 5 years of equal annual reimbursement and the interest adopted for the similar cases of Agricultural Bank is 14% per year.

3) Financial Analysis by Cash Flow

Analysis was carried out for the following cases.

- Crop cultivation through irrigation and drainage improvement
- Plastic green houses
- Introduction of hybrid cows
- Integrating all aspects of the project

In the case of crop cultivation through irrigation and drainage improvement, judging from one year profit loss, deficit continues up to 4th year and surplus will be generated from 5th year. In this case, if repayment period is changed to 10 years, surplus will appear after 6th year. In the case of the plastic green houses, surplus will be generated in the 5th year.

Regarding the introduction of hybrid cows, two cases were carried out. In one farmer's case, surplus will be generated in the 3rd year. However, in the case of hybrid cow, introducing to all the farmers in the project area, as the long interval investments, surplus will appear after 8 years.

In the case of the integrating all aspects of the project, surplus will be generated from 8th year due to the hybrid cows introduction.

6.5.4 Socioeconomic Synergy Impact

Besides direct economic benefits, the implementation of the project is expected to bring about the following socioeconomic synergetic benefits.

- The stable production of wheat and rape, which are basic major crops, is maintained with the introduction of irrigated farming method and contributes to the improvement of self-sufficiency rate and oil seed production.
- Increasing of farmland utilization generates employment opportunity in the area. In particular, as the cotton cultivation is employed as the basic crop, vast manpower is anticipated for cotton harvest.
- By introducing hybrid cow breeding, rural women can participate in productive activities, and can raise their position in the society.
- As evidently proven by the financial evaluation, the farmer's economic surplus is increased to a great extent with the implementation of the Project. A rapid increase in funds in farmer's

economy by far exceeds cost of improving living standard.

- Regional commercial activities become vigorous owing to an increase of farmers' income as well as generation of major employment opportunity.
- Increasing of farmer's income and employment opportunity reduce economic differences between the project area and urban area.
- Introduction of forage crop to the rotation of cropping system and combining cultivation of crops and animal husbandry is judged as an environmentally sustainable agricultural system while preventing soil erosion.

Meanwhile, the implementation of the Project increases the income of local farmers and improves their living standard to a great extent. An improved income further increases purchase power of the local farmers and vitalizes local commercial activities. Also, an increased purchase power and vigorous commercial activities are expected to promote local industries. Additionally, this project introduces combined agricultural management, and the negative impact of the implementation over surrounding ecosystem will be alleviated as far as possible.

6.5.5 Comprehensive Evaluation

The project aiming at diversification of farming activities which are within the context of project shall offer opportunities for local farmers who have been persistent to the traditional low productive and unstable farming, to get rid of present unfavorable situation, to make capital formation and to lead, as a consequence, to enjoy a more affluent and better rural life. Although this project is not so large in scale, their target areas represent the leading farm production of the Gorgan plain and thus their success in terms of agricultural diversification shall have greater impact socio-economically.

Thus, the implementation of the project is judged as valid with the result of economic and financial evaluations as computed from tangible benefit. In addition, socio-economic impact evaluated from intangible benefit is also judged as sufficiently expectable. The Project is evaluated as a sustainable agricultural development plan considering the environmental situation. Moreover, the implementation of the project is justified to be feasible from technical combined with the technology verifications and tests. Furthermore, the Pavand RPC is verified as a suitable organization from the operational viewpoint. Accordingly, it is recommended that a high priority should be given to the project for its implementation in an early stage.

6.6 Projects to be Implemented in Phase - 1

In succession to the Feasibility Study of the Tazeh Abad Project, it is highly necessary to implement the Project Plan mentioned above for the Tazeh-Abad Project. Besides, it is also equally important to carry out the Technical Development Project as mentioned in the Scenerio of Agriculture development in Gorgan Plain.

The Technical Development Project should be carried out to analyze and to solve the different problems of the Gorgan plain under a coordinated research project. By this project, technology developed in the research farm shall be transferred effectively to other farms in the Project area and similar areas in the Gorgan plain and other regions.

The details of the technical development project and the Study to be carried out are discussed below.

6.6.1 Technical Development Project

(1) Necessities of the Project

The necessities of the technical development project are summarized as follows:

1） Analyzing Different Problems of the Area under a Single Project

There are many problems of farming in the Study Area as mentioned below:

- Establishment of low cost and effective irrigation and drainage system
- Technology of water management and saving irrigation water
- Technology of desalinization and of alkalization
- Planning of optimal farm size
- Integration of agriculture and animal husbandry
- Production technology of high quality storage roughage (silage and hay)
- Improvement of marketing system of farm materials and products
- Promotion and improving management of the rural production cooperatives

These problems have relevance to each other, and need to be solved in an integrated manner in a single project.

2) Coordinated Research

In regard to research administration, the relation between the national research institutes and their branches in the Golestan province is realized vertically, being divided for every special field of study. Most of the researches are carried out independently without sufficient communication and cooperation with other fields of studies and to solve the real problems of the farms.

3) Technical Transfer to the Farmers

The technical development project is an effective way to transfer the technology developed in the farm to the other farms in the Project area and similar areas in the Gorgan plain and other regions. The farmers can also become a part in the technical cooperation project, since the project is carried out in one of the areas, which belong to the farmers. The project farm functions as a demonstration farm to the farms of the surrounding areas.

4) Communication between Research and Extension Organizations

The technical transfer between the research organizations and the extension organizations is not sufficient and there is relatively less communication and cooperation between these organizations. Besides, the administration of the provincial government, which should refer to the results of researches, does not often consult the research organization. In regard to the researchers, it seems that the direct applications of the researches do not fit the actual field conditions.

5) Coordination with Concerned Agencies of the Province

The Provincial Government has different sections divided vertically and linked to the MOA without the right of local autonomy. It means that the administration of the province is carried out often by the intention and advice of MOA in Tehran. Therefore, a major part of the projects in the province are planned and developed without communication and cooperation with other sections of the Provincial Government. For example, irrigation and drainage projects are carried out without considering the water availability, soil salinity, sustainable farming and crop rotation. Because of these reasons, it is expected that some projects will have the soil salinity increased year by year, because of dryness and might become waste land after several years.

In consideration to the present situation of the actual problems in the field, research system, the administration system and the extension system of the province, the technical development project is proposed to solve the problems in the Project Area by integrating various sections of administration, extension and various fields of researches.

(2) Effectiveness of Technical Development Project

The effectiveness of the technical development project are as follows:

a) It is expected to improve the administration system, extension system and research system in Iran, referring to the results of the project as a model. Therefore, the results of the project should be expanded to similar regions in other parts of the country.

b) The development of technology will become effective, and feasible projects of the Provincial Government shall be carried out by integration of various sections of

administration, extension and fields of researches. Besides, the participation of the extension section will permit to raise the level of the extension-workers and an effective extension to the Study Area are expected.

(3) Contents of the Project

An experimental farm of about 50 ha area will be used as a model farm for the development project. The project will be carried out for 5 years which mainly includes the following:

- I Stage – Experimental Farming for 3 years period
- II Stage – Verification Farming for 2 years period

1) Experimental Farming

During the experimental stage of first 3 years, the farm will be divided into smaller areas and experimental farming with different cropping pattern will be carried out. The different types of cropping pattern can be experimented in the experimental farm. The water management aspects including amount of water use, water saving etc. can be experimented in the small plots. However, the trials for irrigation and drainage system and optimal farm size will require a large size field, and can use the large size area. If necessary, irrigation and drainage aspects can be experimented in one irrigation and drainage block.

The integrated and the most suitable farming for the project area region will be found out based on the results of experimental farming during the first 3 years.

2) Verification Farming

During the verification farming in the last 2 years, the integrated and the most suitable farming which will be selected during the experimental farming will be applied for the entire area and the results of the experimental farming will be verified and confirmed. It will also be a good opportunity to demonstrate the results to other farms in the project area and the region.

3) Research Subjects

The subjects of trials to be experimented in the experimental farm are as follows. Most of the experimental trials will be carried out in an integrated manner.

1. Agriculture Technology

a) To establish sustainable crop rotation by introducing pastures, vegetables, and pulses (selection of suitable pastures, cropping pattern, mechanization, methods of irrigation, establishment of production techniques of silage and hay)
b) To integrate agriculture and animal husbandry (production and feeding of high quality roughage)

c) To plan optimal farm size
d) To verify the effect of windbreak trees and their monitoring and evaluation

2. Irrigation and Drainage

a) To establish a low cost and effective irrigation and drainage system
b) To establish techniques for water saving irrigation
c) To study and test the efficiency and feasibility of pipe drain and mole drain
d) To analyze optimal and suitable drainage system to solve the salinization and alkalinization problems of the region

3. Soils

a) To establish technologies of desalinization and alkalization prevention
b) To improve soil fertility with introduction of pastures to crop rotation

4. Cooperatives

a) To promote and improve the management of rural production cooperatives
b) To promote group farming management and new technologies through cooperatives

5. Processing and Marketing

a) To study the possibility of food processing aiming at exporting of grain, dairy products, etc.
b) To improve the supply system of farm materials and the marketing system

6. Overall Farm Management

To verify and evaluate the integrated trials, and study the remaining problems

(4) Requirements of the Project

1) Researchers

The research experts of the following fields need to be assigned in the project:

1. Project leader (Cooperative expert)
2. Agronomist
3. Forage Expert
4. Irrigation and Drainage Expert
5. Water Resources Expert
6. Soil Scientist

Apart from these major experts, experts including marketing expert, computer system engineer (to set up workstation and link with internet and Golestan Agriculture Organization)

and other experts shall be assigned on a temporary assignment basis, based on the necessity during the progress of experimental and verification farming

2) Supporting Staff and Laboratory Personnel

Apart from the above mentioned researchers, the following supporting staff are needed for the project.

a) Supporting staff for the farm activities including machinery operators
b) Laboratory staff
c) Office staff

3) Farm and Research Facilities

The experimental farm of 50 ha should be acquired temporarily for 5 years. After the completion of verification farming, the improved farm shall be again used by the farmer. If the government chooses to use the same farm for further demonstration farming, the farm shall be acquired permanently.

A project office should be built in the project site, which should be big enough to accommodate all the research, administration and laboratory staff of the project.

4) Machinery and Equipment

Necessary machinery and equipment required for independently operating 50 ha farm and equipment necessary for experimentation shall be procured. The following machinery and equipment are required for the farm.

a) Farm Machinery and Equipment
b) Equipment Required for Irrigation and Drainage
c) Soil and Water Laboratory Equipment
d) Computer Workstation
e) Office Equipment
f) Vehicles for transport

5) Total Cost

1. Farm Area

The farm of 50 ha area needs to be rented or to be procured by the Golestan Jihad-e-Agriculture Organization. The farm shall be selected in the Tazeh Abad Project Area.

2. Project Office at the Project Site with Furniture

A new project office (about 600 sq.m) shall be built up at the Tazeh Abad Project site, which shall include the following:

a) Main Office and administration building
b) Laboratory building

The office shall be furnished with necessary furniture including air conditioners. A farm machinery shed of about 1000 sq.m shall be built up for keeping and maintenance of farm machinery.

3. Cost for the farm machinery and equipment

Machinery and Equipment	Price (Rls)	Price (US$)
a) Farm Machinery and Equipment	885,300,000	110,663
b) Equipment Required for Irrigation and Drainage	1,227,200,000	153,400
c) Soil and Water Laboratory Equipment	907,500,000	113,438
d) Computer Workstation	48,000,000	6,000
e) Office Equipment	120,000,000	15,000
f) Vehicles for transport	560,000,000	70,000
Miscellaneous & Price Escalation (15%)	562,200,000	70,275
Total Cost of Machinery and Equipment	4,310,200,000	538,776

4. Yearly Running Cost

The yearly running cost for the research, which includes the following shall be arranged in the yearly budget of the Golestan province.

a) Inputs including seeds, fertilizers, chemicals etc.
b) Salaries for staff including office staff, supporting staff and machinery operators
c) Labor expenses

(5) Participating organizations

The responsible organization is the Government of Golestan Province. The participating organizations are as follows:

a) Sections in the Government of Golestan Province, such as irrigation and drainage, agriculture, soil management, socio-economy, extension, animal husbandry, extension etc.,
b) Branches of the national research institutes,
c) Provincial agricultural experiment stations,
d) Gorgan Agricultural University
e) Other related organizations

(6) Foreign Collaboration

The possibility of foreign collaboration shall also looked for the technical development project based on the policy of the government. The foreign researchers shall work together with their counterparts of the Golestan Agriculture Organization to develop the farming technology, which will be suitable for the Gorgan plain and other similar areas in the province and the country.

Chapter 7 Case Study of Cheldin Project

CHAPTER 7

CASE STUDY OF CHELDIN PROJECT

7.1 Scope of the Case Study and Selection of Area for the Case Study

7.1.1 Scope of the Case Study

Golestan Jihad-e-Agriculture Organization expressed their intention to select a Case Study Area as an example of improvement in the Cheldin Project Area, even though a feasibility study will not be carried out.

The scope of the Case Study as expressed by the Golestan Jihad-e-Agriculture Organization was to conduct a field survey in an area of about 20 ha in order to examine the possibility of agricultural development for the area by proposing a suitable cropping pattern, based on analysis the present conditions of the area.

In regard to other aspects such as drainage, suggestions shall be made for the future study of the project area.

7.1.2 Selection of Area for the Case Study

In discussion with the counterparts of Golestan Agriculture Organization and Rooyesh-e-Mehtar Kalateh cooperative, an area of 26.8 ha was selected in Mehtar Kalateh area. There are four plots in the area with areas of 8.16 ha, 4.60 ha, 12.93 ha and 1.12 ha. The Case Study Area was chosen mainly with the concept of 'joint or cooperative farming' as mentioned below:

1) Bigger Plot Size: In Mehtar Kalateh area, there are many farms, which are divided into smaller areas of approx. 1 ha. In order to promote joint farming in the area, the case study area with a bigger plot size was chosen.
2) Operation of Wells: In Mehtar Kalateh area, there are many wells operating independently and irrigating even for smaller areas. In the Case Study Area, there are 3 wells, which are used for irrigation over a wider area of 8.16 ha, 4.60 ha, and 12.93 ha.
3) Use of Machinery: There are tractors and farm machinery owned by farmers of small land holding size. If the machinery area used jointly, it will increase the efficiency of machinery usage.

7.2 Existing Conditions of the Case Study Area

7.2.1 Natural Conditions of the Project Area

(1) Meteorology and Hydrology

a) Climate Conditions

The case study area is situated at the south-west part, in the Gorgan Central Office

meteorological station area, according to the division utilized in this study by the Thiessen method. The study area has the following meteorological characteristics.

Meteorological Characteristics of the Gorgan Central Office St. (Average)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rain (mm)	44.6	53.7	59.7	49.0	50.6	21.0	18.0	25.9	31.5	52.6	58.0	57.5	522.1
Temperature (^{o}C)	8.3	10.5	15.5	20.2	25.2	27.2	26.6	24.3	18.9	13.7	8.7	7.1	17.2
Evaporation (mm)	30.8	40.4	63.2	106.1	147.5	182.8	190.7	182.4	118.4	85.7	47.2	37.9	1,133.7
Humidity (%)	73.7	73.0	78.7	92.7	85.7	92.7	90.4	72.7	74.0	72.1	70.7	79.3	79.6

b) ETo and Effective Rainfall

The referential evapotranspiration, to be utilized in the calculation of the necessary irrigation water, was calculated from the measurement data of evaporation (class A tank) resulting in the following values. The value of the constant utilized for the calculation was the one recommended by the FAO with the value of 0.65.

ETo (mm)

Station	Jan Bah	Feb Esf	Mar Far	Apr Ord	May Kor	Jun Tir	Jul Mor	Aug Sha	Sep Meh	Oct Aba	Nov Aza	Dec Dey	Annual Sum
Gorgan Central Off.	20.0	26.3	41.1	69.0	95.9	118.9	124.0	118.6	77.0	55.7	30.7	24.6	801.8

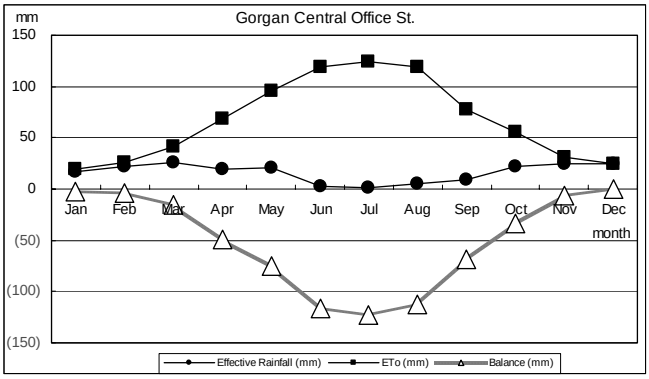
The effective rainfall, also for the calculation of the irrigation necessity, was calculated by the empirical formula of AGLW/FAO resulting in the following values.

Effective Rainfall (mm)

Station	Jan Bah	Feb Esf	Mar Far	Apr Ord	May Kor	Jun Tir	Jul Mor	Aug Sha	Sep Meh	Oct Aba	Nov Aza	Dec Dey	Annual Sum
Gorgan Central Off.	16.8	22.2	25.8	19.4	20.4	2.6	0.8	5.5	8.9	21.6	24.8	24.5	193.3

The comparison of the ETo and Effective Rainfall shows the right figure's characteristics.

The following graph shows the positive and negative balance periods set in this study for the Case Study Area.



ETo and Effective Rain Balance

Jan Bahm	Feb Esfa	Mar Farv	Apr Ordi	May Kord	Jun Tir	Jul Mord	Aug Shah	Sep Mehr	Oct Aban	Nov Azar	Dec Dey
Positive			Negative							Positive	

The effective rainfall in each period shows the following characteristics:

Station	Negative		Positive		Total
	(mm)	(%)	(mm)	(%)	(mm)
Gorgan Central Off.	79.2	41	114.1	59	193.3

The table shows that, in average, about 59 % of the rain occurs during the above mentioned positive period.

c) Well

The actual most important water source in the area is the groundwater, explored in the form of well. The well in a property must be registered and an operation permit shall be issued by the Ministry of Energy. This permission is for one year, so it must be renewed every year.

The following table shows the registered wells information in the Case Study Area.

Case Study Area

Well Information in the Case Study Area

Item	Area Number		
	1	2	3
Land Area (ha)	14.1	8.1	4.6
Well Depth (m)	145	130	160
Type	Artesian		
Settlement Year	1998	1994	1992
Well Pipe Size (inch)	12	12	12
Water Pipe Size (inch)	3	3	3
Qmax (lit/s)	8.0	5.0	5.5
Pump Power (hp)	65	18	18
Setting Depth (m)	45	57	
Max Working Time (hr/year)	2,200	2,200	2,200

source: Ministry of Agriculture (Golestan)

Only the wells are utilized as water source for the agriculture in the Case Study Area.

(2) Soils

The present conditions of the Soils in the Mehtar Kalateh Area were analyzed using the data and information collected through the following soil surveys:

1. Soil Survey by the Golestan Jihad-e-Agriculture Organization
2. Soil Survey by the JICA Study Team

The average pH of the soil in Chedin Area is about 8.0. The EC of the soil varies from a very low 0.7 to 3.4 mS/cm with an average value of 1.5 mS/cm. The organic carbon content is mostly in the medium level with an average value of 1.33% and similarly the total nitrogen is in the medium level of 0.14%. The level of phosphorus varies widely from a low value of 3.5 ppm to a very high value of 52.5 ppm and the average value is about 15 ppm. The level of potassium also varies widely from a low value of 120 ppm to a very high value of 580 ppm and the average value is about 260 ppm. In general, the fertility level of the northern part of the Mehtar Kalateh area towards the Gharasu river is slightly better than the southern part of the area. Texture of the soils normally varies from medium textured silt loam (silt > 60% and clay <20%) to heavy textured silty clay loam (silt >55% and clay >25%). There are also very heavy textured silty clay (silt >50% and clay >30%) and clay (clay >40) soils at some locations of the Mehtar Kalateh area.

Soil sampling was carried out at 4 locations of the Case Study Area and 3 samples (one sample per each profile) were collected at each location. In 2002, rice was cultivated in the locations 1,2 and 3 and soybean was cultivated in the location 4.

The results of soil analysis are shown in Table 7.2.1 As it can be seen from the Table 7.2.1, the average pH of the soil is about 8.0. The EC of the soil is at a very low salinity level of less than 2 mS/cm (S0). In general, if the soils have EC values of less than 2mS/cm, the salinity effects are negligible except for the most sensitive crops. Sodium Adsorption Ratio (SAR) is also low with values of less than 8 (S0=SAR<8). Cation Exchange Capacity (CEC) values, which shows the overall fertility status of the soil are in the slightly higher range of above 25. Organic carbon and total nitrogen are also in the slightly higher range. Phosphorus and Potassium are also in the higher range at the root zone depth.

The most significant property of the soil in the Case Study Area is the texture of the soil with high clay content, which is mostly above 50%. In most of the cases, the clay content of the bottom layers are still higher than the top layers. Because of the clayey texture and the low infiltration rate, flooding occurs in the area, whenever there is heavy and sudden rain in and around the project area. Suitable drainage system is highly essential to solve the flooding problem of the area.

Table 7.2.1.2 Soil Characteristics of Cheldin (Mehtar Kalateh) Project Area (2001)

Sample No.	Depth (cm)	pH	EC (mS/cm)	SAR	CEC (me/100 g)	$CaCO_3$ (%)	O.C (%)	Total N (%)	P (Ava) ppm	K (Ava) ppm	Cations (meq/l)			Clay (%)	Silt (%)	Sand (%)	Classification
											Na^{+}	$Mg^{++}+Ca^{++}$	Sum Cations				
(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
L1-1	0-30	7.7	1.2	2.8	30.0	15.5	0.82	0.18	18.0	250	6.5	11.0	17.5	46	24	30	C
L1-2	30-60	8.0	1.0	2.8	32.0	18.0	0.22	0.12	4.5	180	6.0	9.0	15.0	70	26	4	C
L1-3	60-90	8.1	1.2	2.6	28.0	30.5	0.51	0.05	3.5	160	6.0	11.0	17.0	72	24	4	C
L2-1	0-30	7.9	2.1	7.8	33.2	17.5	1.67	0.17	12.5	260	17.5	10.0	27.5	62	30	8	C
L2-2	30-60	8.1	1.6	6.3	32.0	23.5	0.78	0.08	4.5	190	12.5	8.0	20.5	68	26	6	C
L2-3	60-90	8.2	1.3	4.3	30.0	30.0	0.38	0.04	4.5	130	10.0	11.0	21.0	68	22	10	C
L3-1	0-30	7.9	1.4	5.8	32.0	16.0	1.67	0.17	11.5	240	11.5	8.0	19.5	64	30	6	C
L3-2	30-60	8.2	1.0	3.7	26.0	31.0	0.57	0.06	3.5	140	7.3	8.0	15.3	62	32	6	C
L3-3	60-90	8.3	1.0	3.5	26.0	33.0	0.34	0.03	3.0	110	7.0	8.0	15.0	54	26	30	C
L4-1	0-30	7.9	1.0	2.4	33.0	15.5	1.58	0.16	8.0	290	5.0	9.0	14.0	56	40	4	Si-C to C
L4-2	30-60	8.1	1.3	4.6	30.0	19.5	0.95	0.10	4.0	200	9.2	8.0	17.2	58	36	6	C
L4-3	60-90	8.1	2.0	5.0	18.0	35.0	0.42	0.04	2.5	100	13.8	15.0	28.8	48	48	4	Si-C to C

(3) Environment

1) Major Environmental Problems

The major environmental problems of the Mehtar Kalateh Case Study area are as follows:

- Heavy clay content of the soil
- High groundwater table
- Water quality, especially the heavy sediment load of Gharasu River

The texture of the soil in the Case Study Area is mostly clay with high clay content, which is mostly above 50%. In most of the cases, the clay content of the bottom layers are still higher than the top layers. Because of the clayey texture and the low infiltration rate, flooding occurs in the area, whenever there is heavy and sudden rain in and around the project area. Excessive ploughing of the soil because of poor drainage has resulted in soil structural problems, which are increasing the poor drainage and water logging problems.

The groundwater level in the upper aquifer is higher in most of the area. This problem is further increased by the ponding method of irrigation during rice cultivation, which raises the groundwater table and causes excessive flooding during heavy rain.

The water quality especially the heavy sediment load of Gharasu river is another significant envivornmental problem of the area. The Gharasu river, which acts as the main drainage canal for all of the excess drainage water from a greater catchment area, is partially blocked with sediments from the foothills area. The Gharasu river reaches its full capacity once or twice in a year and cause flooding. Although some of the sediments are received from the farms and urban lands on the flat areas, it appears that much of sediments come due to erosion from the highly erodible foothill soils and from the more steeply sloping parts of the Piedmont plain. According to USDA classification, the salinity and alkalinity level of water of Gharasu river is C3S1, and the salinity of water is in the high level. This condition was noted both during the first and the second field surveys. Total Suspended Solids (TSS) is also higher in many cases. Resolving environmental concerns of Gharasu river is important, especially avoiding the discharge of sediments and nutrients into the Caspian sea and further destruction of the fish species.

2) Environmental Monitoring and Management System (EMMS)

An environmental monitoring and management system shall be established to monitor the environmental impacts on the project area and the surrounding areas, aiming at adequately protecting the environment both during and after the project implementation. EMMS should include suitable environmental monitoring and management measures to avoid or mitigate potential adverse impacts. The monitoring and management measures corresponding to

potential adverse impacts mentioned above are listed below.

1. Integrated catchment management to minimize flows and reduce sediment
2. Regular monitoring of water quality in Gharasu river and appropriate use of fertilizers and agriculture chemicals
3. Regular monitoring of soil properties and proper recommendation of fertilizers and chemicals
4. Inclusion of proper drainage system and increase drainage intensity of canals
5. Proper distribution and usage of surface water and use of water saving methods
6. Regular monitoring of groundwater and use of water saving methods
7. Regular monitoring of atmospheric pollution and adoption of proper farm management practices

Golestan Provincial Directorate of Environment and Golestan Province Agriculture Organization shall coordinate together in establishing EMMS for the province. The relationship between the Government and the community is very important for the success of the project. The project should be developed and implemented in close collaboration with the local farmers. The awareness of the farmers in regard to erosion, soil loss, soil fertility and productivity needs to be increased. Farmers need to alter the management and tillage practices, contour cultivation etc. The farmers should be encouraged to more profitable and sustainable tree crops in the hilly areas.

7.2.2 Socioeconomic Condition of the Project Area

(1) Population and Economic Activities

The area of Case Study belongs to Deh Mehtar Kalateh and covered by RPC Rooyesh-e-Mehtar Kalateh (hereinafter referred as 'RPC Mehtar Kalateh'). Number of households, population, main race, and religion in Deh Mehtar Kalateh are mentioned in the table shown below.

Number of Households, Population, Race, and Religion

Name of Deh	Household	Population (person)	Main race	Religion
Mehtar Kalateh	About 750	About 3,500	Mazandarani (80%), Sistani + Persian from Khorasan Province(20%)	Islam Shiite

Source: Hearing from Rural Council of Deh Mehtar Kalateh (June, 2002)

Main economic activities of the settlers in Deh Mehtar Kalateh are agriculture, animal husbandry and public servants. About 30% of farmers deal with animal husbandry besides agriculture. *Ab-ban mirab* (a traditional water manager) exists in this Deh to manage water in the paddy field. The area of the Case Study is divided into 4 plots. Number of families who hold and farm in each plot, and the area and the products of each plot are summarized in the

table shown below.

Number of Families, Area, and Products in 4 Plots

No.	No. of Families	Area of Plot (ha)	Products
1	5	11	- Wheat - Rice - Soybeans
2	3	8	- Wheat - Rice
3	3	4	- Wheat - Rice
4	1	1	- Wheat - Rice

Source: Hearing from the representatives of 4 plots (Oct. 2002)

All of the persons who hold the farmland in the area of Case Study belong to the majority of Deh Mehtar Kalateh. In other words, they are Mazandarani and Islam Shiite. Their economic activities or main income sources are agriculture or agriculture and animal husbandry. Moreover, all of them are the members of RPC Mehtar Kalateh.

(2) Marketing

1) Marketing Channel of Agricultural Products

In the Case Study area, wheat, rice and soybeans are cultivated. The RCOs, which is the main buyer of wheat and rice, located in Yazri, Siejevar, Kordkuy City, and Aq Qala City are 6km, 8km, 15km, and 30-35km away from the area of Case Study respectively. Oilseed Product Development Company is located at about 15-20km. The condition of the road from farmland to main road is not good but the main road is well-paved.

2) Marketing Problems of Agricultural Products

a) Price of the products

Although the prices of the products mentioned above are satisfied, the farmers in the Case Study area are a little unhappy with the price of wheat, because the imported wheat from foreign countries is much more expensive than that of local one. And the price of rice fluctuates much more than that of wheat although both of them is guaranteed by the government. Soybeans production is not profitable compared to rice. The farmers will willingly produce more wheat and rice, if the price of wheat and rice increases. In that case, Iran will not need to import rice from other countries such as Pakistan and Thailand.

b) Relationship with middlemen and other buyers

In case of rice, RCO buys 30% of the total harvest. The sales are paid just after selling, which is a large benefit for the farmers. Therefore, RCO is the most reliable buyer for them at present. On the contrary, middlemen are unreliable because they pay by check and is time

consuming. But the farmers can negotiate with the middlemen and, sometimes they can sell the products at more than the guaranteed price.

c) Market information

Enough market information can be obtained from TV and newspaper.

d) Transportation means and cost

The ratio of truck owners is less than 10% in Deh Mehtar Kalateh. All of the farmers do not have a truck, either. In case of wheat and rice transportation, they borrow a truck from a truck syndicate in Kordkuy and Bandar-e-Torkman. Soybeans are transported by a small tractor, which is some time dangerous. Sometimes, they cannot borrow a truck for shipping rice on time and it gets wet although rice should be sold just after harvesting. Rental fee of a truck is Rls.3,500/t for any product and it is reasonable enough. In addition, RCO pays half of the rental fee but Oilseed Product Development Company does not pay any rental fee.

(3) Agrarian Society and Gender

a) Social structure of Deh

The representatives of Deh Mehtar Kalateh are the members of Rural Council, elders, and mullahs. The society consists of land owner farmers, tenant farmers, agricultural labors, animal breeders, public servants, and small storekeepers, *ab-ban mirab* (a traditional water manager). Among the representatives, Rural Council plays a big role. In Deh Mehtar Kalateh, *Ab-ban mirab* is in charge of water distribution in paddy fields. The method of water distribution is determined by 1) the farmland and well owner or *Ab-ban mirab* in trust with the owner in case of well or 2) the RPC in case of dams and reservoirs.

b) Gender

The main race of Deh Mehtar Kalateh is Mazandarani. The details of Mazandarani women are described in 3.2.4 Rural Women.

(4) Rural Production Cooperatives (RPC Mehtar Kalateh)

a) General

The area of Case Study is covered by RPC (Rural Production Cooperatives) Mehtar Kalateh as mentioned first. General information of RPC Mehtar Kalateh is shown below.

General Information of RPC Mehtar Kalateh

Prefecture	Year	No. of Covered Deh	Covered land area (ha) (irrigation)	Membership (persons) (M:F)	Main Race	Average holding area (ha) (Mini/ Max)
Kordkuy	1997	2	1,558 (1,200)	450 (440:10)	Mazandarani, Sistani	1-3 (0.25/ 15)

Source: Hearing from the RPC Mehtar Kalateh (Oct, 2002)

The eligible persons to be a member of RPC are those who hold farmland in the covered area (Dehs) by RPCs. The entrance fee or the share of RPC Mehtar Kalateh is Rls.100,000/ha for both rain-fed and irrigated farmland. Now, 10% of the members have not finished the payment, which shows a low level of cooperation of some members.

b) Organizational structure

RPC Mehtar Kalateh comprises of a RPC President employed by RPC itself, and an accountant, an agricultural technician dispatched from Jihad-e-Agricultural Organization, a person in charge of mechanization, 4 agricultural machinery operators (tractor, combine, and transplanter), and an executive board selected among the members.

c) Activities and decided matters of RPC

Activities of RPC Mehtar Kalateh are 1) Training of the members through technical extension (ex. appropriate crops), 2) Setting a member's plot as a demonstration plot, 3) Setting an experimental plot in the RPCs' farmland, 4) Purchasing a rice trans-planter and lending it to the members at Rls.300 thousand/ha (2001), 5) Purchasing wheat combines (for 400ha) and lending it to the members at Rls.40 thousand/ha (2002), 6) Selling agricultural inputs, 7) Analyzing soil, 8) Extending the method for prevention of weed and insects, 9) Buying cotton at the better price than middlemen, and 10) Preparing a pickles factory.

Decided matters are 1) Getting grant from Agriculture Bank for Drought Damage Prevention Plan established by the RPC, 2) Installing farm roads (8km), 3) Land grouping (it is decided but not proceeded due to two farmers' objection), 4) Making cadastre and topographical maps for identifying the area of farmland, the location of farm roads, and wells, and 5) Water distribution (by the executive board).

d) Benefit and debt

The benefit and debt of RPC Mehtar Kalateh are shown in the following table.

Benefit and Debt of RPC Mehtar Kalateh (2001)

Benefit (Rls.)	Debt (Rls.)	Repayment/year (Rls.)	Purpose of Debt
12 million (in black)	400 million	7.5 million	N.A.

Source: Hearing from the RPC Mehtar Kalateh (June, 2002)

e) Strengths/ opportunities and weakness/ threats (problems)

Strengths/ opportunities and weakness/ threats (problems) of RPC Mehtar Kalateh, which the RPC points out are described in the table blow.

Strengths/ Opportunities and Weakness/ Threats (problems) of RPC Mehtar Kalateh

Strengths/ Opportunities	Weakness/Threats (Problems)
l) RPC can purchase agricultural machineries and contribute to increases of production. 2) RPC contributes to decreasing cost through extension of appropriate amount of seed, fertilizer, and agricultural chemicals. 3) The members can buy agricultural inputs very timely and increase their production. 4) RPC can extend new cultivation techniques.	l) Shortage of budget 2) Decrease of governmental subsidy 3) The mechanization plan (purchasing agricultural machinery) of Jihad-e-Agriculture Organization was not appropriate, and some RPCs had to sell the machines. 4) Farmland is detached. (It is hard to meet together although discussion is required to implement the project) 5) The guaranteed prices of some agricultural products are not set.

Source: Hearing from the RPC Mehtar Kalateh (June, 2002)

f) Problems with the RPC members in the Case Study Area

(i) Agricultural inputs

The prices are reasonable enough. But there is shortage of fertilizer for wheat. Therefore, they have to buy it at the market, which is more expensive than the fertilizer supplied from the RPC. Moreover, it was reported that Iranian agricultural chemicals are not effective and quality of seed is not good (mixed with insects and barley's seed, and broken). The support for the inputs of rice production is not sufficient. There is no subsidy for seeds and fertilizer from government. Agricultural chemicals for rice cultivation are subsidized but their quality is bad.

(ii) Agricultural machinery

Rental is not expensive, but the farmers cannot use the machinery when those who want to use it concentrate in one period.

(iii) Technical instruction (extension)

Training course conducted by technicians belonging to the RPC. Individual instruction is also given. The farmers are satisfied with contents and frequency of the extension service. But they request distribution of manuals or brochure and putting up of posters on recommendable cultivation and for attention on disease and insects.

(iv) Water distribution

There is no irrigation and drainage network in the covered area of the RPC. The farmers joined in the RPC for receiving technical instruction and easier access for agricultural inputs. At present, they use groundwater from their individual wells for irrigation. It costs much because of maintenance, sperm oil or gasoline, and engine oil. They expect to receive cheaper water from a reservoir or a dam.

(v) Request to RPC Mehtar Kalateh from the members in the area of Case Study

They are satisfied with the RPC because they think the RPC tries its best actively within a present limitations such as shortage of tractors and attachment, and agricultural inputs. But they request that the RPC will clear the segment from the river located next to their fields with a lot of segment and is easily inundated once it rains.

(5) Agricultural Assistance and Finance

1) Agricultural Assistance

Golestan Jihad-e-Agriculture Organization provides the loan for purchasing domestic animals. Khomeini Foundation and Ministry of Labor and Social Problems also provide this kind of loan. The persons who graduated from a university but do not have any occupation have a priority to get the loan.

2) Agricultural Finance

The farmers borrow money from a bank, mainly Bank Saderat because it is close and has a long history around this area. In case of borrowing from Bank Saderat, they need a letter of inquiry from Rural Council. Interest rate for agricultural production is 16%/year. For well construction loaned from Agricultural Bank, the interest rate is 20%/year. Agricultural Bank (branch) started its operation recently around this area. In case of borrowing from Agricultural Bank, they can obtain loan through the RPC.

(6) Social Infrastructure

1) Access Road to the area of Case Study

The Case Study area is located in Deh Mehtar Kalateh. It is 15 km from Kordkuy City, and 15km from Gorgan City. The condition of the road is good and it is well-paved.

2) Electricity, Water Supply, Gas and Communication (Telephone Line)

A power transmission line is installed in Deh Mehtar Kalateh but not in the field. Water supply facilities and sewers are also installed in the Deh. Gas pipeline is not installed yet but it is planned by Rural Council of Deh Mehtar Kalateh. Moreover, a telephone line is already installed.

3) Education

There are 2 public primary schools (boys and girls), 2 public lower secondary schools (boys and girls) and 1 public upper secondary school (girls) in Deh Mehtar Kalateh. Most of the students go to until the level of upper secondary school.

4) Health and Medical Care

The medical care system is well arranged. There are a small public clinic and a large health center in Deh Mehtar Kalateh.

7.2.3 Agricultural Conditions of the Project Area

(1) General

In the Kordkuy District, annual precipitation is about 700mm in the normal years, and 600mm in the drought year, 2001. The area is rich in irrigation water, such as more rainfall, rich groundwater from the Elbourz Mountains, as compared with Tazeh-abad. However, the area has also suffered the damage of drought since 1993. That is, the yield of soybean decreased from 2.2 tons/ha to 1.6 tons/ha, and that of cotton also decreased to 65% of the yield in the normal years. There is no damage of drought in wheat. The reasons of these decreases in yield were considered that it did not rain at time of need and it rained at time of needless, which caused diseases of crops, such as fusarium.

Soil of the area is low salinity, except of the northern part of the area, but has problem of heavy textured soil, which is difficult to till. To solve the problem, the organization of extension and research carries out to transfer the techniques of tillage to cover every soil conditions.

The area is divided into three agricultural zones as follows;

1. The northern zone between the Gharasu River and the national main road; There are many low land and crops cannot cultivate in autumn due to inundation. Therefore, seeding of winter crops is delayed. Cotton, wheat and rice are cultivated, and vegetables cannot be cultivated in this zone. Rice is cultivated if irrigation water is enough. Soybean cannot be cultivated due to high salinity in some parts of the zone.
2. Middle zone between two main roads: This zone has suitable soil and high productivity. Besides of cotton, wheat and rice, vegetables, especially leafy vegetables, are cultivated in autumn, and water melon, tomato, radish and cucumber are cultivated in spring.
3. The foot of the Elbourz Mountains; it is more rain than other zones. Cotton, wheat and rice are cultivated.

The Mehtar Kalateh is located in the northern zone of Kordkuy District, and the case study area is located in the lowest land area. The land height above sea level of the case study area is from – 22 to – 20 m. On the other hand, soil texture is classified as heavy soil texture, which contains 46 to 64% of clay at soil layer of 0 to 30cm in depth. Therefore, the low land area, including the case study area, suffers from flooding by heavy rainfall, especially in the beginning of autumn and the end of winter to spring. As a result, farmers cannot often sow seeds of wheat. Agricultural condition of the lowland area surrounded with the Gharasu River, the west and east branches of the Shast Khola River, which includes the case study are, is as

shown in the following Table.

Agricultural Conditions of the Low Land Area Surrounded by the Gharasu River, West and East Branches of the Shast Khola River

	Items		Conditions				
1	Number of farm households in the area		76				
2	Area of land in the area		219 ha				
3	Number of field plots in the area		124				
4	Number of irrigation wells in the area		43				
5	Number of irrigation wells by the years passed since construction						
	1)	Over 20 years	12				
	2)	10 ~ 20 years	16				
	3)	5 ~ 10 years	5				
	4)	Less 5 years	10				
		Sum	43				
6	Number of tractors in the area		31				
7	Number of tractors by the years passed since purchase						
	1)	Over 20 years	27				
	2)	10 ~ 20 years	3				
	3)	5 ~ 10 years	0				
	4)	Less 5 years	2				
		Sum	31				
8	Area submerged during over 10 days by flood in the area		25 ha				
9	Number of the cases of farmers' cooperation in the area						
	1)	The cases of group farm works	2				
	2)	The cases of common wells	9				
	3)	The cases of common use of tractors	6				
	4)	The cases of cooperative use of fields to expand a field	5				
10	Crop production						
	Crops	Area (ha)	Average yield (ton/ha)	Cost (Million Rls/ha)	Unit price (Rls/kg)	Total production	Total profits Million Rls.
	Wheat	189	3.0	1.07	1,050	567 tons	595
	Rice	165	6.0	6.25	2,400	990	2,376
	Cotton	30	1.5	2.93	2,850	45	128
	Soybean	10	1.5	1.75	1,770	15	27
	Total	394				1,617	3,126

From this Table, the agricultural conditions of the low land, including the Case Study area, are characterized as follows;

1) The farming scale is 2.9 ha in average, and the field size is 1.8 ha in average.
2) There is one well per 3 plots.
3) Old irrigation wells, which passed over 10 years since construction, are 65% of total wells (43 wells). On the other hand, new wells, which passed less 5 years since construction, reach 23% of total.

4) There is one tractor per 2.5 farm households, and old tractors, which passed 20 years since new one, reach 87% of total (31 tractors) and new tractors, which passed less 5 years from purchase, are 6% of total.
5) Number of cases of farmers' cooperation in the low land is 2 cases in farm works, 9 cases in common use of wells, 6 cases in common use of tractor, 5 cases in cooperative use of fields to expand a field plot and to increase efficiency of mechanization, respectively.
6) Area and yields of cultivated crops are 189 ha and 3 tons/ha in wheat, 165 ha and 5.5 ~ 6 tons in rice, 30 ha and 1.5 tons in cotton, 10 ha and 1.5 tons in soybean, respectively. Yields of most of crops, except rice, are low. Therefore, paddy rice is most suitable in the low land area.
7) The cultivated area is 199 ha in winter and 195 ha in summer, 394 ha in total, respectively. Total farmers' profits in 219 ha of the lowland area are 3,126 million Rls., of which the profit by paddy rice production account for 76% of the total profits. However, the production of paddy rice by irrigation of wells' water has been prohibited by Government for the purpose of conservation of underground water.

(2) Case study Area

There are 4 plots in the Case Study area with areas of 8.2 ha of the first plot, 12.9 ha of the second plot, 4.6 ha of the third plot and 1.1 ha of the fourth plot. All lands belong to the relatives and their families, and the joint farming is carried out in each plot by 3 families in the 1st plot, 8 families in the 2nd plot, 3 families in the 3rd and the 4th plot.

Land conditions of the case study area are the worst in the lowland area, such as lowest in altitude, heavy textured soil, several ponding in winter every year, etc. Therefore, the cropping pattern in the area is generally "paddy rice – wheat". Irrigation water source is well. When well's water is not enough for paddy rice cultivation, soybean is cultivated in a part of the plot instead of paddy rice. At present, paddy rice are cultivated in all plots, except 2 ha of the 2nd plot, which is cultivated soybean instead of rice due to shortage of well's water.

In each plot, the cooperative field use, common use of irrigation water by well and cooperative farm works are carried out. The products are allotted to each family.

It is considered that the present cropping pattern "paddy rice – wheat" is the best, unless land conditions are improved by any ways, such as forcible drainage by pump, soil dressing with light textured soil, etc.

Yields of crops under irrigation by well in the case study area are 6 to 7 tons/ha of rice, 2 to 4 tons/ha of wheat, and 2 to 2.5 tons/ha of soybean, respectively.

In regard to mechanization, tractor cannot work in field in winter (December to March) due to wet land. And also, combine cannot work in field for harvest of paddy rice. Therefore, paddy

rice is harvested by hand and transported to combine on a road, and then is threshed by combine.

7.2.4 Irrigation and Drainage Conditions

Present condition of irrigation and drainage in the Case study area is grasped through the field reconnaissance, and through hearing survey from landholders of the farmland, the RPC, and the engineers of provincial government who are in charge of this area.

(1) Location conditions of the farmland

The Case Stduy Area locates in Matah Kholate in Cheldin, closed to Gharasu River which runs from East to West while collecting many drains from tributaries. The location of the area is 1.5km west from the Yasaqi-Bandar-E-Torkaman Road. The Gharasu River located 1.7-2.0km north from the area running toward the west. It is about 16km from this point to Caspian Sea. The altitude of this area is around 42.0m. Farmland is scattered on all sides and topographical slope is 1/2,300 from the south to the north toward the Gharasu River.

A small drainage river namely Shast Kholah River runs about 650m away from the eastern part of the area. On the other side, the tributary is divided from the Shast Kholah River at the upstream side and runs towards the north along with the west boundary of the area. Unpaved farm road whose total width is 4.5m runs from east to west in the southern part of the area and it ensures the transportation to Yasaqi - Bandar-E-Torkaman road.

The area is divided into small or large 4 owners' plots. These plots form field blocks. Each field block is divided into smaller plots.

(2) Water source

The water sources are rainfall and individual wells in the area. There is no well in the northernmost farmland shown in the figure and therefore it is supplied water from Plot ①.

(3) Problems on irrigation and drainage

The problems on irrigation and drainage pointed out from the landowners are as follows.

a. It is impossible for a tractor to enter into the farmland due to frequent inundation during rainy season,
b. The Gharasu River flows backward every several years. In this case, drainage of the drainage river is retarded, and
c. Groundwater level of the farmland is always high, which effects badly on crop cultivation.

These matters are as same as the problems which were pointed out during the hearing

conducted in the first and second field surveys in Cheldin Area. The inundation damage reported by the farmers is not caused by a small drainage river flowing in the Gharasu River from the mountainous areas, as a result of examination. This situation is limitedly happened in case of the flood in around 1/50 possibility year. The soil of the area includes more than 50% of clay and it is very high. Moreover, as reported before, in case of crop cultivation mainly by using agricultural machinery in the clayey soil, passing of the agricultural machinery often causes soil compaction. The farmers point out formation of hard pan at 60-70cm from soil surface.

7.3 Constraints and Potentials for Development

7.3.1 Constraints for the Development

(1) Natural Conditions

1) Meteorology and Hydrology

The drainage conditions of the area is the main constraint. The area has two main drainage canals (one is the Shast Khola river) that drain the water to the Gharasu river. But the smooth slope of the Gharasu river and the canals, as the deposition of sediment and improper vegetation in the canal creates difficulties to the drainage process.

2) Soils

As discussed in the section 4.2, the major problem of the soils in the Mehtar Kalateh is the heavy texture of the soil with a high clay content of above 50%. Because of the clayey texture, the infiltration rate is low and causes flooding during heavy rain. In most cases, the clay content of the bottom layers is higher than the top layers. It is believed that the small clay particles might have percolated downwards during the rice cultivation during the past 10-20 years. Because of the clayey texture, tillage is also a problem in this soil. Although the fertility status of the soil is in the higher range, it is normally recommended to apply fertilizers of NPK because of the heavy clay content of the soil.

(2) Socioeconomic Conditions

1) Not well-maintained farm road

Farm road is not well-maintained in the field. So, it is difficult to transport the harvest to main roads.

2) No electricity in the filed

Electricity is installed in Deh Mehtar Kalate but not in the field. They use groundwater from their individual wells operated with petroleum and engine oil. Therefore, fuel expenses are high.

(3) Agricultural Conditions

Constraints for development in the case study area are as follows;

1) Basically, the case study area is in the worst condition for agriculture, such as low land, ponding by heavy rainfall, heavy textured soil, poor drainage, etc.
2) There is no canal of surface irrigation water. It is necessary to support with Government to introduce surface irrigation, especially for paddy rice cultivation.
3) Therefore, farmers invest in construction of well. The cost of construction of well is very high, about $ 25,000, and the cost of repairs is also very high, $ 12,000.
4) There are no crops, which correspond to the cost of well construction. Paddy rice is better than other crops.
5) Measures of improvement of low land involve the huge budget. Support with Government is necessary.
6) Cooperative construction, management and water use of wells are necessary, taking advantage of an opportunity of well's renewal.
7) Cooperative purchase, maintenance and use of farm machinery are necessary, taking advantage of an opportunity of tractor's renewal.
8) Land readjustment having proper field plot and proper land leveling.
9) Cooperative land use by small-scale farmers.
10) Establishing the high productivities in agriculture and husbandry by increase of yield and decrease of cost.
11) Decrease of debts.

7.3.2 Potentials for the Development

1) Water Resources

The relative abundant groundwater of the area is one of the potentials for development. But new wells must be avoided and replaced by the surface water. The water flowing from the mountains are clean and is more qualified to be used as irrigation water (in respect to the water salinity) than the Gorgan river. Another aspect to avoid well utilization is the high cost of its construction. The initial investment for the well carries to the production of crops with high valued products, that has high water demand as the rice, to pay the initial investment.

Other important item is to maintain the forest in the mountains and surrounding the water source to protect them. The intense destruction of the vegetation can carry to the decrease of the water sources, and at the end destruct all water cycle in the area. So, the conservation works shall be very important to maintain the actual water source potential in the Gharasu basin. The forestation of the Gharasu river's margins shall be a good protection for erosion that carries a great volume of sediments to the Gharasu river's downstream every year.

The monthly average discharge of the Shast Kola river, that flows beside the Case Study Area, and Gharasu river, where the Shast Kola river discharges it's water, are as follows.

Monthly Average Discharge

(m3/s)

Local	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
	Aba	Aza	Dey	Bah	Esf	Far	Ord	Kor	Tir	Mor	Sha	Meh	
Shast Kola River	0.39	0.41	0.43	0.51	0.72	1.04	1.14	0.86	0.61	0.47	0.40	0.41	0.61
Gharasu (Seah Ab)	0.95	1.93	2.67	2.79	3.64	4.43	3.75	2.24	0.51	0.10	0.10	0.70	1.98

The basin of the Gharasu river is about 10 times smaller than the Gorgan river. The average discharge at Basir Abad St. (near the Gorgan river mouth) and Seah Ab St. (near the Gharasu river mouth) also reaches to a difference of 10 times. The Basir Abad discharge reaches almost to a monthly average of 40 m^3/s when the Seah Ab only reaches to 4 m^3/s.

The discharge of Gharasu river is not constant. Most of time between June to September, the Gharasu river presents a discharge of zero or near zero. The tributaries of Gharasu river, like Shast Kola and Naharkoran rivers, have a very small discharge.

So, future development of the water surface can use the potential of those tributaries to collect and conduct the water to areas where the agricultural lands concentrates. It means, utilize the combined potential of those small rivers. But the project shall be deeply studied to avoid future environmental problems. Before this study, the existing wells can be used as water source.

The priority, if the agriculture production is going to be diversified, shall be the improvement of the drainage condition in the area.

7.4 Basic Guidelines of the Agricultural Development Model

To make the agricultural development plan and to carry out the farming in the Case Study area, there are some prerequisites as follows;

1) Improvement of soil conditions; Executing the forcible drainage of low land by pump, soil dressing with light textured soil, physical improvement of soil, sub-soiling, execution of drainage in the fields with low cost.
2) Land readjustment having proper field plot and proper land leveling
3) Establishing of cropping pattern and suitable rotation to keep the sustainable farming
4) Establishing of proper cooperative organization in mechanization and maintenance of farm machines in crop cultivation, management and maintenance of wells, of other facilities, such as plastic green house, etc.
5) Establishing of supporting system for farmers, such as technological transfer of farming, cultivation techniques, profitable marketing, loan conditions to be easy for repayment,

guarantee of farm products, etc.

6) Establishing of supply system of farm materials and farm machinery.

The plan is composed of the crop production with crop rotation, the hybrid cow farming of 10 heads, and cucumber production in plastic green house for the farmers of small-scale farming.

(1) Cropping system

The proposed cropping system is one of the models of crop rotation. The model can make various variations by change of crops, especially, the small-scaled farmers could not help introducing vegetables in exchange for cotton and pea in order to increase the profits..

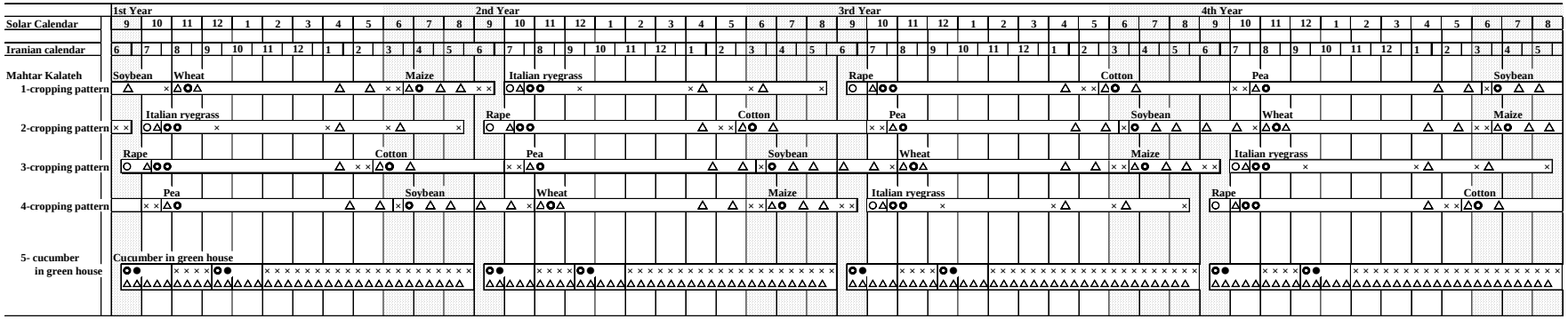
The proposed rotation is as follows:

1) The four-year rotation is adopted, because the number of main crops in winter is four (Fig. 7.4.1).
2) The composed crops in the rotation are 7 crops, such as wheat, annual grass (Italian ryegrass), rape, cotton, pea, soybean and grain maize for fodder. Crop rotation is made by combination of growth periods of crops.
3) The cropping pattern is “wheat – maize – Italian ryegrass – rape – cotton – pea - soybean”.
4) In the plan, a farmer divides his field into four plots and cultivates four cropping patterns every year. Therefore, a farmer produces 7 crops every year to keep balance of agricultural income every year.
5) The reasons of selecting of these crops were described in Chapter 6.
6) These crops should be examined before introduction in the project area, especially on pea and Italian ryegrass.

(2) Animal husbandry

The proposed plan is same as the plan in Tazeh-abad (Table 6.3.3).

Fig. 7.4.1 Growth Period and Rotation of Crops (Plan for Mahtar Kalateh)



Note 1) ◎ Sowing ● - Transplanting △ - Irrigation × - Harvesting

2) ▭ Dry season

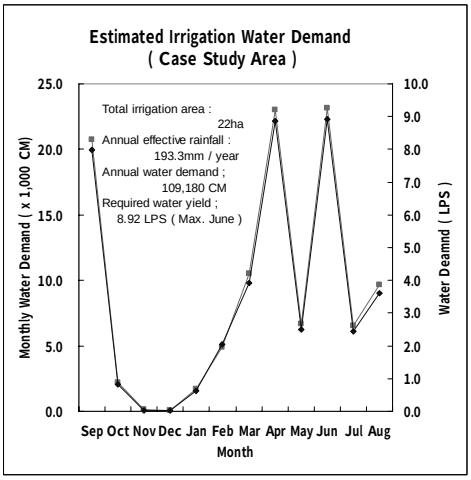
3) In the both survey area, the four-year crop rotation is adopted. The composed crops in the rotation are wheat, rape, grasses (Italian ryegrass) or clover, pulse crops (pea) as winter crops, and cotton, soybean and maize as summer crops.

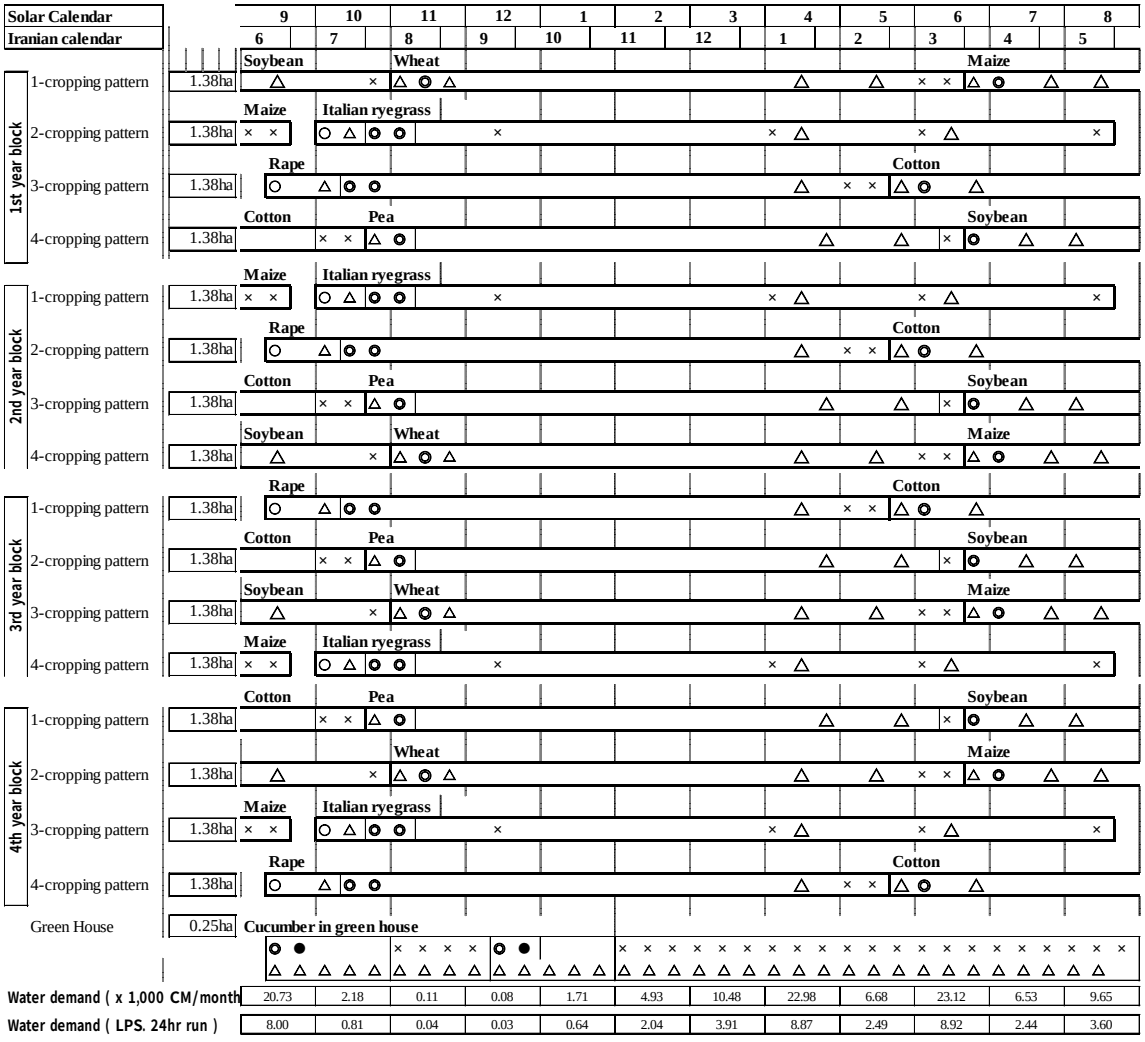
4) Livestock farming, which each farmer raises mother cows of 10 heads, is carried out by each farmer besides above mentioned farming.

5) In small scale farm households, cucumber cultivation through out the year in a greenhouse is introduced.

(3) Irrigation Water Requirement of the Area

Irrigation water requirement of the Area of 24ha under the proposed cropping pattern will be 121,720 MCM/year. Monthly demand varies as shown in the figure. The highest demand is in June in the dry season (It is almost same in April). For obtaining such demand the required capacity of water source might be 10.0 LPS for the whole area. It is assumed that basin irrigation is followed with an efficiency of 0.43





Proposed Cropping patter and Monthly Irrigation Requirement

(4) Existing conditions of farm economy in the project area

When the farmer cultivated each cropping pattern in every one ha, the annual profits by cultivation of seven crops are as shown in Table 7.4.1. From the Table, the net income of cultivation of 4 ha is about 11.443 million Rls.

Table 7.4.1 Annual Profits by Crops (average in Golestan Province, 2001; for Mahtar Kalateh)

Crops		Cotton	Wheat	Rape	Grass	Pea	Soybean	Maize (grain)
Items								
Cost	Land preparation	334,120	162,700	275,760	-	235,330	363,660	247,000
	Sowing	270,850	421,050	148,760	-	319,300	323,380	344,360
	Management	1,448,890	284,110	407,780	-	387,960	786,770	1,336,850
	Harvesting	878,840	200,440	166,280	-	384,820	276,030	270,000
Total	Million Rls./ha	2.933	1.068	0.999	1.754	1.327	1.750	2.198
Yield	kg/ha	1,788	3,190	2,200	4,000	1,200	1,523	2,558
Unit price	Rls./kg	2,850	1,050	2,050	825	1,870	1,770	890
Gross income	Million Rls./ha	5.096	3.350	4.510	3.300	2.244	2.696	2.277
Net income	Million Rls./ha	2.163	2.281	3.511	1.546	0.917	0.946	0.078

Note: 1) Yields of cotton, wheat, soybean, rape, pea and maize are used the average in cheldin. Yields of grass and pea are the estimated figures.
2) Costs and unit prices of crops, except grass, are used the average in Golestan Province.
3) Cost and unit price of grass are estimated in Table 7.4.6.

(5) Economy of the integrated farming model

Annual profits in the integrated farming of agriculture of 4 ha and animal husbandry of hybrid cows of 10 heads are shown in Table 7.4.2. In this case, the average in Cheldin area is used as yields of cotton, wheat, rape, maize, soybean and pea. Estimated figure was used for yield of grass. Besides, the average in Golestan Province is used as costs and unit prices of crops, except grass. The net incomes are composed of 2.3 million Rls. of wheat, 3.5 million Rls. of rape, 1.5 million Rls. of grass, 0.9 million Rls. of pea, 2.2 million Rls. of cotton, 0.9 million Rls. of soybean, 0.1 million Rls. of maize and 24.5 million Rls. of stock farming, and 36.0 million Rls. in total.

However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, annual profits of the integrated farming become about 16 million Rls.

On the other hand, in case of the same integrated farming with high level of technology (Table 7.4.3), the net incomes are composed of 4.1 million Rls. of wheat, 6.0 million Rls. of rape, 1.5 million Rls. of grass, 2.2 million Rls. of pea, 3.2 million Rls. of cotton, 2.0 million Rls. of soybean, 0.3 million Rls. of maize and 24.5 million Rls. of stock farming, 43.9 million Rls. in total.

Table 7.4.2 Annual Profits of Farm household in Farming of 4 ha in Mehtar Kalateh (Average Plan)
(7 crops cultivation under irrigation in 4-years rotation and raising of hybrid local cows of 10 heads)

Item	Yield kg/ha	Producers' unit price Rls./kg	Gross income Million Rls./ha	Production cost Million Rls./ha	Net income Million Rls./ha	Base of estimate
Crops introduced to the plan						
Wheat	3,190	1,050	3.350	1.068	2.282	Note 1), 2)
Rape	2,200	2,050	4.510	0.999	3.511	Note 1), 2)
Grass (hay)	4,000	825	3.300	1.754	1.546	Note 1), 3)
Pea (or lentil)	1,200	1,870	2.244	1.327	0.917	Note 1), 2)
Cotton	1,788	2,850	5.096	2.933	2.163	Note 1), 2)
Soybean	1,523	1,770	2.696	1.750	0.946	Note 1), 2)
Maize (grain)	2,558	890	2.277	2.198	0.079	Note 1), 2)
Total annual net income of 4 ha in four-year crop rotation					11.443	
Animal husbandry						
Raising of hybrid cows of 10 head			49.120	24.596	24.524	Note 4)
Total annual net income					35.967	

Note: 1) Yields of cotton, wheat, rape, maize, soybean and pea are used the average in Cheldin. Yields of grass are the estimated figures.
2) Costs and unit prices of crops, except grass, are used the average in Golestan Province.
3) Cost and unit price of grass are estimated in Table 7.4.6.
4) Gross income , production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table 6.2.3).

Table 7.4.3 Annual Profits of Farm household in Farming of 4 ha in Mahtar Kalateh (High Level Plan)

Item	Yield kg/ha	Producers' unit price Rls./kg	Gross income Million Rls./ha	Production cost Million Rls./ha	Net income Million Rls./ha	Base of estimate
Crops introduced to the plan						
Wheat	5,000	1,050	5.250	1.109	4.141	Note 1), 2)
Rape	3,500	2,050	7.175	1.191	5.984	Note 1), 2)
Grass (hay)	4,000	825	3.300	1.754	1.546	Note 1), 3)
Pea	2,000	1,870	3.740	1.519	2.221	Note 1), 2)
Cotton	3,000	2,850	8.550	5.329	3.221	Note 1), 2)
Soybean	2,200	1,770	3.894	1.942	1.952	Note 1), 2)
Maize (grain)	3,000	890	2.670	2.390	0.280	Note 1), 2)
Total annual net income of 4 ha in four-year crop rotation					19.345	
Animal husbandry						
Raising of hybrid cows of 10 head			49.120	24.596	24.524	Note 4)
Total annual net income					43.869	

Note: 1) With regard to yields, the highest yield of cotton, wheat, rape and soybean were used in Cheldin at present. Data of yield of maize, grass and pea are the estimated figures.
2) Wheat, cotton, rape, pea, soybean and maize: Data were examined about each component of production costs. The average (2000-2001) in Golestan Province was generally used. Besides, the necessary fertilizer, such as potassium, sulfur, micro-elements, etc. were added with actual cost (Table 7.4.4, 7.4.5).

3) On annual grasses, there is no data on production costs in detail. Therefore, cost of each component of production costs were made with reference to that of wheat and cotton. 4 tons of hay was estimated as total yield per ha of 3 times harvesting (Table 7.4.6).
4) Gross income , production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table 6.3.3).

However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, annual profits of the integrated farming become about 25 million Rls. In this case, with regard to yields, the highest yield of cotton, wheat, and rape in Cheldin at present are used as yields in the Table. Yields are 5 tons per ha of wheat, 3.5 tons per ha of rape, 4 tons per ha of grass, 2 tons per ha of pea, and 3 tons per ha of cotton, 2.2 tons per ha of soybean, 3 tons per ha of maize, respectively. Data of yield of grass is the estimated figures. Data of production costs of wheat, cotton, rape, pea, soybean, maize and grass were examined about each component of production costs. The average (2000 ~ 2001) in Golestan Province was generally used. Besides, the necessary fertilizers, such as potassium, sulfur, micro-elements, etc., were added with actual costs (Table 7.4.4 and 7.4.5). On annual grass (Italian ryegrass), each component of production costs is made with reference to that of wheat and cotton (Table 7.4.6).

Table 7.4.4 Cultivation Method and Production Cost (wheat under irrigation, for Mahtar Kalateh)

Farm Materials					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Sterilizing seeds	kg	180	11,300	203,400	
Fertilizer (phosfate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	hours	12	25,000	300,000	
Pesticide	kg	2	14,000	28,000	Sevine
Herbicide	litter & kg	1 lit. + 15 g	79,400	79,400	Topic, grand Star
Insurance due				8,000	

Table 7.4.4(Cont.) Cultivation Method and Production Cost (wheat under irrigation, for Mahtar Kalateh)

Farm Works					
Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (drill)		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		2	15,000	30,000	
Irrigation water charge		2	30,000	60,000	
Spraying pesticide		2	25,000	50,000	
Harvesting (with combine)		1	200,000	200,000	
Transporting products to market				35,000	
Total cost				1,469,300	
Income by sale of straw				360,000	200packs, each 1,800 Rls
Net production cost				1,109,300	

Note :

1. When yield is 5,000 kg/ha, and producer's price is 1,050 Rls/kg, the gross income per ha is 5,250,000 Rls. Therefore, the net income is 4,140,700 Rls/ha.
2. The gross income, production cost and the net income per kg are 1,050 Rls/kg, 222 Rls/kg and 828 Rls/kg, respectively.
3. The net income is about 79 % of the gross income, and about 373 % of the production cost.

Table 7.4.5 Cultivation Method and Production Cost (Cotton under irrigation, for Mahtar Kalateh)

Farm Materials					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seed	kg	40	2050	82000	
Fertilizer (phosfate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	150	315	4,725	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	hours	28	30,000	840,000	6 inch well, 7 hrs x 4 times
Pesticide	kg	12	20,000	240,000	
Herbicide	litter	2.5		28,500	Sonalan
Insurance due				14,000	

Table 7.4.5(Cont.) Cultivation Method and Production Cost (Cotton under irrigation, for Mahtar Kalateh)

Farm Works					
Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing	ha	1.5	75,000	112,500	
Disc harrow	ha	4	37,500	150,000	
Sowing (drill)	ha	1	40,000	40,000	
Making drain	ha	1	30,000	30,000	
Pesticide	ha	1	30,000	30,000	
Transporting seeds and fertilizer	ha	1	12,000	12,000	
Fertilization	ha	2	15,000	30,000	
Weeding	ha		-	559,000	Manual (33 personsx13,000
Cultivator	ha			25,000	| Rls), car(8,000Rls)
Spraying pesticide	ha	4	30,000	120,000	| and oversee worker (50,000 Rls)
Irrigation		4	30,000	240,000	Manual (4 times x 2 persons)
Harvesting (with combine)	ha			945,000	Manual (labor 57 x 15,000Rls,
Transporting products to market	kg	2,200	40	88,000	| oversee worker 3 x 25,000Rls, car
Other cost				295,400	| 8,000Rls
Profit of fund				271,380	
profit of management				647,353	
Other cost				295,400	
Total cost				5,329,258	

Note :

1. When yield is 3,000 kg/ha, and producer's price is 2,850 Rls/kg, the gross income poer ha is 8,550,000 Rls. Therefore, the net income is 3,220,742 Rls/ha.
2. The gross income, production cost and the net income per kg are 2,850 Rls/kg, 1,776 Rls/kg and 1,074 Rls/kg, respectively.
3. The net income is about 38 % of the gross income, and about 60 % of the production cost.

Table 7.4.6 Cultivation Method and Production Cost (Italian ryegrass under Irrigation/for Mahtar Kalateh)

Farm Materials					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seeds	kg	20	8,000	160,000	Grass; Setaria (glauca)
Fertilizer (phosfate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	hours	24	25,000	600,000	6 inch well
Insurance due				8,000	

Table 7.4.6(Cont.) Cultivation Method and Production Cost (Italian ryegrass under Irrigation/for Mahtar Kalateh)

Farm Works

Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (broadcast seeding))		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		3	15,000	45,000	
Irrigation water charge		2	30,000	60,000	
Harvesting		3 times x 5 processes	20,000	300,000	Mower, rake, baler, trailer (5 processes).
Transporting products		3	35,000	105,000	Transporting to Store house.
Total cost				1,753,500	

Note:
1. When total hay yield is 4/ha, and producer's price is 825 Rls/kg, the gross income per ha is 3,300,000 Rls. Therefore, the net income is 1,546,500 Rls/ha.
2. The gross income, production cost and the net income per kg are 825 Rls/kg, 438 Rls/kg and 387 Rls/kg, respectively.
3. The net income is about 47 % of the gross income, and about 88 % of the production cost.

From the Table 7.4.3, the total farmers' profits in the Case Study area of 26.8 ha and 12 farm households are 129 million Rls. by crop cultivation, 294 million Rls. by animal husbandry, 423 million Rls. in total, respectively.

It is considered that the integrated farming model of high level is the feasible development plan in near future.

7.5 Suggestions for Future Study

The proposed agricultural development plan for the case study area based on the cropping pattern discussed above would be applicable to the similar low land areas in the piedmont region.

In regard to other aspects, the following suggestions are made for the future study of the project area.

7.5.1 Drainage Related Aspects

As it was already discussed, the soil texture in the Case Study area is heavy clay and therefore, the following aspects are to be proposed as solution options, which shall be studied in more detail in the future study.

a. To provide sub-surface drainage system
b. To provide surface drainage canal against the surface inundation
c. To provide drainage gate at drainage river mouths

d. To conduct drainage river improvement

(1) Sub-surface drainage system

Sub-surface drainage system shall be introduced and placed aimed to sub-surface soil improvement, which is prevailed with clay. The subsurface drainage system shall be placed as grid system with regular intervals.

An open canal type catch drain shall be planned for drain collection at the downstream of the sub-surface drain system. This drainage canal will also collect water from the vicinity area, while guiding the drain to a drainage river.

Flow depth of Shast Kolah River fluctuates by season, which flows into Gharasu River while passing in the vicinity of the area. In case of high water level in the Gharasu river, backward flow might occur. Hence, sluiceway shall be planned at the river mouth.

(2) Surface drainage canal

The main cause of inundation occurring often in the rainy season is prevention of vertical percolation of surface water into lower soil layer by the low permeable soil. Besides, earthen walls of land enclosure and levees in the lots function to prevent surface flow on the farmland and hardly drain into the river.

As an important solution option, it is proposed to construct surface drainage canal, open type canal, presupposing farmland reclamation and consolidation. The drainage system should be provided under consideration of drainage river in a district. Hence the Government needs to obtain acceptance of farmers for the planning.

(3) Sluiceway at the river mouth of drainage rivers.

It is reported that the events of backward flow of high water of Gharasu river to tributaries are seldom. But farmers report inundations near the confluences of tributaries in rainy season. The reasons for the difference of these reports are due to river bed elevation of Gharasu, which varies gradually, raises day by day with sediment, because of high sedimentation of Gharasu river. It is said that almost every year the Government pours efforts to excavate the river bed and the depth of excavation is about 1.0m anytime. So it can be understood that the backflow occurs with certain frequency under such conditions, as farmers report.

Hence sluiceway shall be provided at the river mouth of tributaries of Gharasu for solving such problem, which will be two gates type sluiceway with electric motor driving to meet with the width of the tributaries.

(4) River improvement of tributaries.

Present condition of Shast Khola river, one of the tributaries of Gharasu river, is in good

condition now. But the depth of another tributary is about 50 cm, which runs down to Gharasu along the western border of the Area. This depth cannot allow any drainage system in the Area. So river improvement is necessary for this tributary.

7.5.2 Land Reform Related Aspects

Land reform is an important aspect to be studied for the project area. Farmers in the area are adapting ‘Basin Irrigation Method’ under the situation of without land leveling of those four farm blocks. Irregularities of land surface cause partial inundation or non-uniform watering and also causes partial differences of crop growth. Besides, most of the measures of improvement described before can not succeed without land reform. Also the cost might get higher. For eg., the main precondition of introducing surface drainage canal system is land reform. Under such consideration land reform work shall be studied in more detail.

(2) Water Source and Facilities

Apart from surface water, wells are used for irrigation in the Project area. Availability of the water yield from the wells still needs to be studied. If the farmers can accept the concept of ‘co-operative farming’ under a certain rules, then those wells can contribute more to maintain the water balance among the existing farm blocks.

Chapter 8 Conclusion and Recommendations

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The Gorgan Plain of Golestan Province is an important agricultural production area in the Province and is considered to possess a high agricultural potential due to its large plain area. However, severe natural conditions such as low rainfall (300-700 mm), high rates of evaporation, severe salinity and alkalinity problems of the soil, and drainage limitations due to high groundwater level restrict the agricultural production of the area. Besides, the farmers have been just practicing traditional type of dry farming agriculture, with relatively low yields. On the other hand, groundwater has been extensively used in the southern part of the Study Area near the piedmont plain leading to over- exploitation of groundwater resources.

In order to improve the agriculture production in the Gorgan plain, Golestan Jihad-e-Agriculture Organization has been implementing irrigation and drainage schemes and four (4) such schemes have been implemented in the Study Area, since 1994. Besides, with the purpose of promoting 'cooperative farming', Rural Production Cooperatives (RPCs) were formed with the farmers of the irrigation and drainage schemes being the members of the cooperatives. However, because of the budgetary constraints, the irrigation and drainage schemes are not yet fully completed and the constructions are still carried out year by year based on the budget availability.

Because of these irrigation and drainage schemes, a part of the Study Area was irrigated during the past two or three years. However, the major constraint is the availability of water in the Gorgan river for irrigation. At present, 96 MCM/year of water has been used for irrigating 15,000 ha by Voshmgir dam, using Gorgan river water source. Besides, after the construction of Golestan dam-1 in the upstream side of the Gorgan river 2 years ago, 51MCM/year of water is used for irrigating 10,000 ha in the upstream side. In addition to these factors, it was reported that the dry climate during the past 2 years was another factor which increases the seriousness of water shortage.

Therefore, even after construction of irrigation and drainage system, the farmers in the Study Area still practices dry farming agriculture in most of the area, because of insufficient and unstable water supply. In addition, the water quality of Gorgan river falls within a high salinity range of C3S1 to C4S2. Without proper drainage system, the salinity and alkalinity problems also continue to exist.

At this juncture, various solution options available to solve the different problems related with water resource, soil, socioeconomy, irrigation and drainage and agriculture were analyzed and

the basic concept of agricultural development of the Study Area was developed. In order to achieve sustainable agriculture development of Gorgan plain with maximum utilization of available resources, the following measures should be carried out in an integrated manner.

- Raising the stability and availability of irrigation water
- Enhancing soil improvement measures
- Reinforcing irrigation and drainage infrastructure facilities
- Introduction of site oriented farming programs to suite with the severe natural conditions
- Setting up measures to expand farm income through integrated and improved farm management
- Improving support policy for farmers and the farmers organization
- Strengthening research and development to support agriculture development of the region
- Development of the extension systems
- Building up of mutual trust between farmers and the government agencies
- Diversification of local market demands

It is obvious that all the measures can not be implemented in one time, and it is not appropriate to do so. They have to be prioritized and synchronized with each other. With this understanding, a 'Phased Development Approach' is to be set and a development scenario was prepared for the agricultural development of the Gorgan Plain. Tentatively 3 phases with 5-year period for each stage are proposed, starting in 2005, considering that this Study will be finished on spring of 2003. Those stages are as follows:

a.	Preparatory stage	from the spring of 2003 to the end of 2004	2 years
b.	Phase-1	from 2005 to 2009	5 years
c.	Phase-2	from 2010 to 2014	5 years
d.	Phase-3	from 2015 to 2019	5 years

In the preparatory stage, all of the necessary preparations to commence the phased development need to be completed during this period, including necessary coordination with relevant agencies and stakeholders and requests for foreign collaboration, if any.

Phase-1 (2005 to 2009) is to be set as a period of 'Preparation for Sustainable Agricultural Development and Rural Activation'. The activities during this phase are to be focused on the improvements of the existing irrigation and drainage schemes, and not on the expansion of irrigated area because of insufficiency of water resources.

Phase 2 is to be set as 'Improving the present agriculture and Preparation for wider development'. The results of the research and development activities during the previous phase should be continued further for the examination on new subjects. The facilities to be proposed in the 'Integrated Water Resources Management in the Gorgan Plain' shall be implemented to facilitate sufficient water availability for the plain.

And, Phase-3 is to be set as ‘Implementing Sustainable and Wider Range of Agricultural Development’. The results of research and development activities should be extended in the region and sustainable agricultural development should be carried out in the Gorgan Plain.

The selection of the priority area was the first step to provide a ‘success story’ to the farmers in the vicinities for the future development of the region. Tazeh Abad Project Area was selected for the Feasibility Study. In addition, an area of 24 ha was selected in the Cheldin project area, which shares a part of piedmont agricultural area, and contributes significantly for the main agricultural production in the Golestan province.

The agricultural development model developed for the Tazeh Abad Project Area is composed of crop production with crop rotation, hybrid cow farming and cucumber production in plastic green house for the farmers of small-scale farming. The proposed cropping system shall be considered as one of the models of crop rotation. Five (5) crops included in the rotation, such as wheat, annual grass (e.g. Italian ryegrass), rape, cotton and pea. It is also proposed to increase the drainage density of the project area apart from completing existing irrigation and drainage facilities. It is also proposed to strengthen the RPC and agricultural credit system.

The implementation of the project in Tazeh Abad Area is judged as valid with the result of economic and financial evaluations as computed from tangible benefit. In addition, socio-economic impact evaluated from intangible benefit is also judged as sufficiently expectable

The problems of the Cheldin Project Area including the Case Study Area are much different than the northern part of the Gorgan plain. Wells are widely used for irrigation and salinity, alkalinity problems are relatively very low. Cropping pattern is generally ‘rice-wheat’. The major constraint in the soil is its heavy clay texture and poor drainage condition. Four-year rotation is proposed, including the crops, such as wheat, annual grass (Italian ryegrass), rape, cotton, pea, soybean and grain maize for fodder. The proposed cropping pattern is ‘wheat – maize – Italian ryegrass – rape – cotton – pea – soybean’.

Drainage problems and other problems of the Case Study area can not be solved within the area itself, but should be solved in the whole project area. The improvements measures should include subsurface drainage system, surface drainage canal, sluiceway at river mouth of the river, river improvement of tributaries and land reform in the project area. The project should be developed and implemented in close collaboration with the local farmers. The awareness of the farmers in regard to erosion, soil loss, soil fertility and productivity needs to be increased. Farmers need to alter the management and tillage practices, contour cultivation etc. The farmers should be encouraged to more profitable and sustainable tree crops in the hilly areas.

8.2 Recommendations

The following items are recommended to achieve the targets of the present study.

a) Joint Coordination of the Stakeholders Concerned with the Project

Joint coordination of all the stakeholders related to the Project including all the relevant government agencies and farmers' organizations is highly important for the success of the project. Research, administration and extension system of the province should work together in a systematic way to solve the problems of the Project Area. The governmental agencies should have more opportunities to discuss with farmers by using participatory methods and a mutual trust between the governmental agencies and the farmers should be built up.

The governmental agencies should discuss the problems in the field condition and the solution options should be derived based on the actual conditions including the financial conditions of the farmers. Once proper guidance are given to the farmers, the farmers should be allowed to operate by themselves so as to promote their independency and the 'sense of ownership' of the irrigation and drainage facilities.

Joint coordination between all the government and other agencies concerned, close relationship between the government agencies and the farmers and mutual trust between all the stakeholders of the Project are considered as the main keys for the success of the Project.

b) Expeditious Implementation of Development of the Priority Area

Tazeh Abad priority area can be developed as a sustainable development model for the future Gorgan plain agriculture development and therefore expeditious implementation of development plan of the priority area is necessary.

The Technical Development Project should be carried out, as the first stage of the development plan. The different problems of the Gorgan plain can be analyzed under a single project and a coordinated research shall be carried out.

The development of technology will become effective, and feasible projects of the Provincial Government shall be carried out by integration of various sections of administration, extension and fields of researches. Besides, the participation of the extension section will raise the level of the extension-workers and an effective extension to the Study Area is expected.

By this project, technology developed in the farm shall be transferred effectively to other farms in the Project area and similar areas in the Gorgan plain and other regions. The farmers can also become a part in the technical cooperation project, since the project is carried out in one of the areas, which belong to the farmers. The project farm functions as a demonstration farm to the farms of the surrounding areas.

This project is expected to improve the administration system, extension system and research system in Iran, referring to the results of the project as a model. The results of the project should be expanded to similar regions in other parts of the country.

c) Study on Integrated Water Resources Development and Watershed Conservation

It is highly important to secure stable and sufficient water resources to realize sustainable agricultural development in the Gorgan Plain. Besides, watershed conservation is also necessary to prevent the sedimentation and flooding problems in the Gorgan plain. Therefore the Study on 'Integrated Water Resources Development and Watershed Conservation in the Gorgan Plain' shall be carried out to clarify availability of usable water resources and the watershed conservation measures necessary for the area.

The Study shall be carried out for the watersheds of Gorgan and Gharasu rivers, clarifying the actual water use condition and water demand in the area. The usable water resources shall be studied, pointing out the water shortage by area in the watershed. The exact water circulation in the whole area shall be recognized, while evaluating the effective water distribution.

An efficient water use and watershed conservation in future for the regional development, based on the availability of water resources will be studied. It will also recognize the water availability in both the watersheds, creating the basic conditions to succeed projects such as 'Water Supply from the Mazandaran Province'.

This study shall also re-evaluate the actual conservation and management structures of the dams and water resources, including the present information transmission system. The improvement of the information transmission system includes the transmission of information from the dams and meteo-hydrological measurement stations.

Finally, a well balanced Integrated Water Resources Development and Watershed Conservation Plan shall be formulated, including inter-basin and inner-basin water transfer, considering natural and social environment in each river watershed as well as in the neighboring watersheds.

d) Solving the Drainage Problems of Cheldin Project Area considering the Whole Watershed

In the Cheldin Project Area, the drainage problems of any particular farm or a small area can not be solved just by implementing individual drainage system for that area. The drainage problem has to be tackled for the entire drainage block or for the entire project area. Since land consolidation and reclamation is an important activity to be carried out in the drainage project, there is a necessity to arrive at a mutual consensus among the farmers, in order to implement the drainage project for the Cheldin Project Area. Therefore, the project should be developed and implemented in close cooperation with the farmers of the Project Area.

e) Controlling of Over-Exploitation of Groundwater Resources

In the southern part of the Study Area near the Piedmont plain, wells have been extensively used for irrigation and rice cultivation has been widely practiced in the Cheldin Project Area. Although the Government policy does not promote cultivating rice using groundwater, farmers have been cultivating rice, since it is considered to be more profitable than other crops.

In the Case Study, a cropping pattern including 'wheat – maize – Italian ryegrass – rape – cotton – pea – soybean' is proposed for the Cheldin project area. Integrated agriculture and livestock farming is recommended for the area, and the farmers can increase their income by carrying out integrated farming. Besides, the long term benefits through integrated farming include improving the fertility status of the soil by growing Italian ryegrass and low utilization of precious groundwater resources.

f) Strengthening of Farmers Organizations

It is obvious that strengthening of farmers organizations is one of the basic necessities for agricultural development in the Gorgan Plain. Although the farmers organizations are trying their best to meet the requirement of the farmers, there are many problems such as shortage of machinery, limitation of finance, shortage of technical personnel etc. It is necessary to enhance present functions of the RPCs and new functions should be added. For eg. the machinery available in the Project area shall be grouped together, and the RPC shall provide guidance and supervision for the operation of these farm machinery. By this method, the farm activities in the project area can be smoothly carried out according to the proposed cropping schedule.

In order to solve the serious problem shortage of fund for farming, it is necessary for the RPC to attribute independent agricultural finance function. Initial funds could be borrowed from Agricultural Bank or international financial organizations such as IFAD (International Fund for Agricultural Development).

g) Women's Participation in Agricultural Development

Women's participation in agricultural development should be promoted for proceeding rural women's participation in the society and also for alleviating unemployment problem in this area. This should be considered by race and farming activity. For example, as already mentioned, usually Turkmen women do not join in farming but the women of the other races participate in farming. As for rural processing industries, the working place should be divided into two by sex and women participation should be promoted.

APPENDIX

List of Persons Contacted during the Study

Name	Organization
Ministry of Jihad-e-Agriculture, Tehran, Iran	
Office for International & Regional Organizations	
Dr.Majid Dehghan-Shoar	Director General,
Mr.Mohammad Reza Shariati	Deputy Director General
Mr.Hossein Askari	International Projects Expert and JICA Program Officer
Mr.Yazdani Khoorasgani	International Projects Expert
Monitoring and Evaluation	
Mr.Mohammad Keykha	Expert and Chief, Monitoring and Evaluation
Mr.Amir Fanee	Expert for Studies, Monitoring and Evaluation
Soil and Water Research Institute, Tehran	
Mr.Aziz Momeni	Head, Dept. of Soil Survey and Land Evaluation
Mr.Ghasemi	Head, GIS Division
Agricultural Engineering Research Institute, Karaj	
Dr.Mohammad Ali Shabake	Deputy Director
Dr. Nader Heydari	Expert, Irrigation
Mr.Mohammad R.Mostofi	Expert, Farm machinery
Mr.Abolghasem Haghayeghi	Expert, Drainage
Forage Section, Ministry of Agriculture	
Mr.Sabihere	Forage Deputy
Mr.Tabatabaee	Forage expert
Ms.Nadee	Expert, Alfalfa, Corn
Mr.Basbora	Expert, Sorghum, grass, and barley
Golestan Jihad-e-Agriculture Organization	
Mr.Ali Margdari	Director General
Mr.Esmael Esfandyaripour	Deputy Director General
Mr.Seyed Mohammad Reza Baniaghil	Study Coordinator, Soil and Water Management
Mr.Nader Babajani	Manager, Soil and Water
Mr. Seyed Mohammad Mir Rezai	Manager, Cooperatives and Farming System
Mr.Hossein Taslimi	Deputy Manager, Soil and Water
Mr.Ahmad Reza Ghannad	Expert, Irrigation Structures, Soil and Water
Mr.Nooraddin Sensibli	Expert, Irrigation Structures, Soil and Water

Name	Organization
Mr.Said Rostami	Expert, Cooperative Organization and Regional Economy
Mr.Yusef Hasemi	Expert, Farming System Management
Mr.Sohrab Sohrabi	Expert, Crop and breeding
Mr.Mohammad Reza Abbasi	Expert, Soils and Cultivation
Mr.Rahmatollah Kazeminejad	Expert, Irrigation and Drainage
Mr.Mohsen Zamani	Expert, Irrigation and Drainage
Mr.Seyed Hashem Gandomi	Expert, Agronomy
Mr. Reza Jafari	Manager, Agronomy and Horticulture
Mr.Assadi Hashem Abad	Manager, GIS Section
Mr. Gholam Reza Askari	Expert of Agricultural Machinery
Golestan Jihad-e-Agriculture Organization (Research and Education)	
Mr. Allahyar Nazemi	Deputy, Research and Education
Mr. Shaban Ali Parnak	Research and Educational Assistant.
Mr. Kamal Eslami	Head of Soil and Water Research Section
Dr.Mohammad E.Asadi	Head of Agricultural Engineering
Dr.Mohammad Naseri	Deputy of Cotton Research Institute
Mr.D.Naderi	Director, Soil Analysis Laboratory
Mr.Ahmad Mossavati	Expert, Soil and Land Classification
Mr.Rahmat Allah Behmaram	Oil Seed Crop Breeder
Mr.H.Mokhtarpur	Agronomist, Corn and Forage Crops
Golestan Provincial Government	
Mr.Maghsoodloo	Steering Committee
Mr. Gholizadeh	Deputy of Planning and Administration
Golestan Provincial Directorate of Environment	
Alireza Mehrjoo	Deputy of Environment
Water Organization, Ministry of Energy	
Mr.Mohammad Ibrahim Yakeshi	Hydrogeologist
Mr.Hossein Dehghan	Hydrogeologist
Gorgan University of Agricultural Science and Natural Resource	
Dr.Ahmad Abdelzadeh	Assistant Professor
The Project of Haraz Agricultural Human Resources Development Center	
Mr.Ikeuchi Toru	Team Leader
Mr.Akihiro Tsubaki	Expert on Soil Survey Plan and Design

Name	Organization
Japanese Government Organizations	
Embassy of Japan, Tehran	
Mr.Yukihiro Nikaido	Counselor
Mr.Kentaro Torii	Second Secretary
Mr.Kunihiro Moriyasu	Second Secretary
Japan International Cooperation Agency (JICA), Tehran	
Mr.Izumi Tanaka	Representative
Mr.Katsumi Chida	JICA Expert
Japan External Trade Organization (JETRO), Tehran	
Mr.Junichi Takamiya	Principal Representative
JICA Steering Committee of the Study	
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