Table 5.2.5. Irrigation Improvement Works

Proposed Facilities	Haraz Left Bank Command	Haraz Right Bank Command	Kari Rud Command	Total
Settling Basins (Places)	-	2	1	3
Intakes (Places)	11	11	40	62
Division Works (Places)				
Secondary	80	45	115	240
Tertiary	265	135	320	720
Terminal	355	210	420	985
Canal Improvement (km)	59	19	56	134

Note: Canal improvement is estimated at 10% of the canal length in middle and low land of the Haraz Left Bank Command and in the middle land of the Kari Rud and the Haraz Right Bank Commands.

(4) The Effects by the Irrigation Improvement

The effects by the irrigation improvement are the dissolution of water shortage and the mitigation of sedimentation in the Kari Rud Command and in the part of the Haraz Right Bank Command. Though dissolution of water shortage depends basically on the effect of the Lar dam, the irrigation improvement will also bring the effect on dissolution of the water shortage due to the improper water distribution.

Table 5.2.6. The Effects by the Irrigation Improvement

(Unit: ha)

	Dissolution of Water Shortage			
Sub-areas	Haraz Left Bank Command	Haraz Right Bank Command	Kari Rud Command	Total
High Land	1,590	710	2,040	4,340
Middle Land	3,990	1,900	5,140	11,030
Low Land	4,710	3,860	3,220	11,790
Total	10,290	6,470	10,400	27,160

Note: Details are in Table E.1.5 of Appendix E.1.

Above table shows the area of annual water shortage. This area is equivalent to 40% of the whole paddy land.

(5) Water Management Scheme

Under the limited water resources, the most effective water use is requested. On the other hand, percolation rate will be increased as separating drainage from irrigation at the terminal level in the works of drainage improvement. This increased percolation will be

collected by the area drainage and will return to the downstream irrigation system through the abbandans and the checks. However, present water management system will not satisfy the above matters.

The important factors on water management are summarized as below;

- The river flow of the Haraz will be improved to meet the irrigation demand, reinforcing side flows from the residual basin by released water of 240 MCM from the Lar dam.

- Water management should be achieved quantitatively.

- It is expected to be able to estimate the predictive irrigation demand considerably exactly, because rainfall of 177 mm is small amount comparing with the evapotranspiration in the irrigation period.

- Relating to temperatures of the air and the river water, rice planting starts in the low land and goes to the high land. The difference of planting time is about one month between the low land and the high land.

- It is necessary to monitor the return flow, the water amount stored in the abbandans and the flows in the drainage canals.

Future water management will be proposed as below, taking the aboves into consideration. Since irrigation water will take about a week to reach the terminal level after released from the Lar dam, water management has to be conducted under the predictive system. Consequently, the following are necessary for prediction;

- To reinforce the observation network of snow-mantle and temperature in the mountainous basin and to develop the forecasting computer program for estimating the runoffs mainly caused by snow-melt in the Lar dam and the residual basins.

- To introduce a telemeter system which will monitor the existing river gaging stations from Poloor to Karehsang along the Haraz river.

- To introduce at least one rain gage in each sub-area and to monitor rainfall in the Project Area. Further, to introduce the staff gages in the primary, major secondary and major drainage canals and in the abbandans as necessities. These observed data will be collected in every two or three days by the public telephone network which is proposed in the Rural Living Environment Improvement/Reinforcement Scheme, and to evaluate and adjust the current water supply and the demand.

- To proceed blocking the terminal areas into the unified water management area of about 500 ha on the basis of village mirab system and to collect the information on cropped area and water shortage from the unified areas. The information will be collected by papers or through the public telephone network.

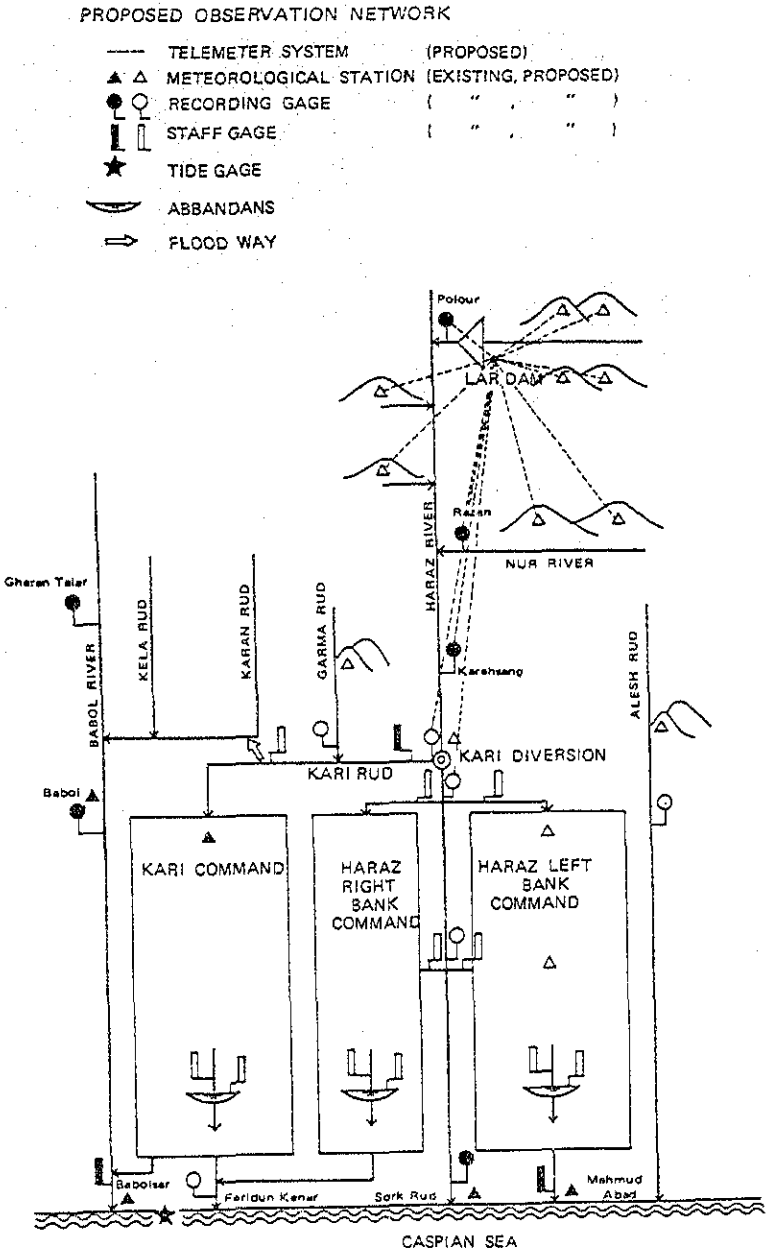
- To prepare the manuals for seasonal water distribution on the basis of cropped area, and each mirab to operate the intakes and the division works quantitatively in accordance with the manual.

The aforementioned outline of the future water management system is illustrated in Figure 5.2.1. For achieving the proper water management, coordination of the MOA and the MOE is very important.

Table 5.2.7 shows the necessary facilities for future water management not only for irrigation but also for drainage.

Table 5.2.7. Necessary Facilities for Water Management

Facilities	Location	Necessary Number
1. Rain-recorder (with thermograph & heater)	Mountainous basin of the Lar dam.	4
	Mountainous basin of the residual basin.	4
2. Rain-recorder (with thermograph)	The Garma Rud Basin	1
	The Alesh Rud Basin	2
3. Rain Gauge	One each in the high land and in the middle land of the Haraz Left Bank Command. Existing rain gauges shall be used in other sub-areas	2
4. Thermograph	Razkeh in the Haraz Left Bank Command	1
5. Water Stage Recorder	The Garma Rud	1
	The Alesh Rud	1
	The settling basin proposed in the Kari Rud	1
	Both ring road bridges of the Haraz River	2
	Feridon Kanar	1
6. Staff-gage	Major irrigation and drainage canals and abbandans	50
7. Telemeter System	To link the river gaging stations at the Lar dam, Poloor, Razan, Karehsang, Kari settling basin and both bridges of the ring road	1
8. Telephone	Using the public telephone network proposed in the Rural Living Environment Improvement/Reinforcement Scheme.	
9. Motor-cycle	To be provided to the mirabs and the village mirabs.	500
11. Transceiver	To be provided to the mirabs	50



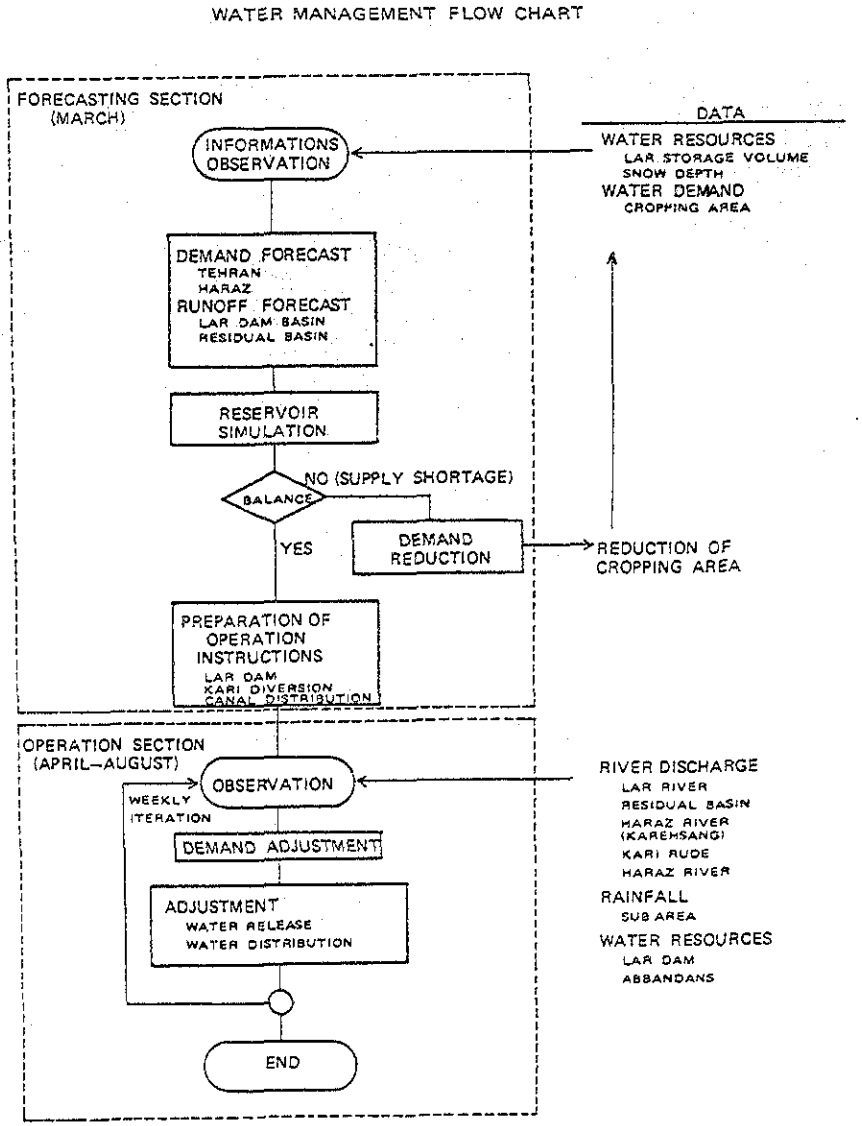
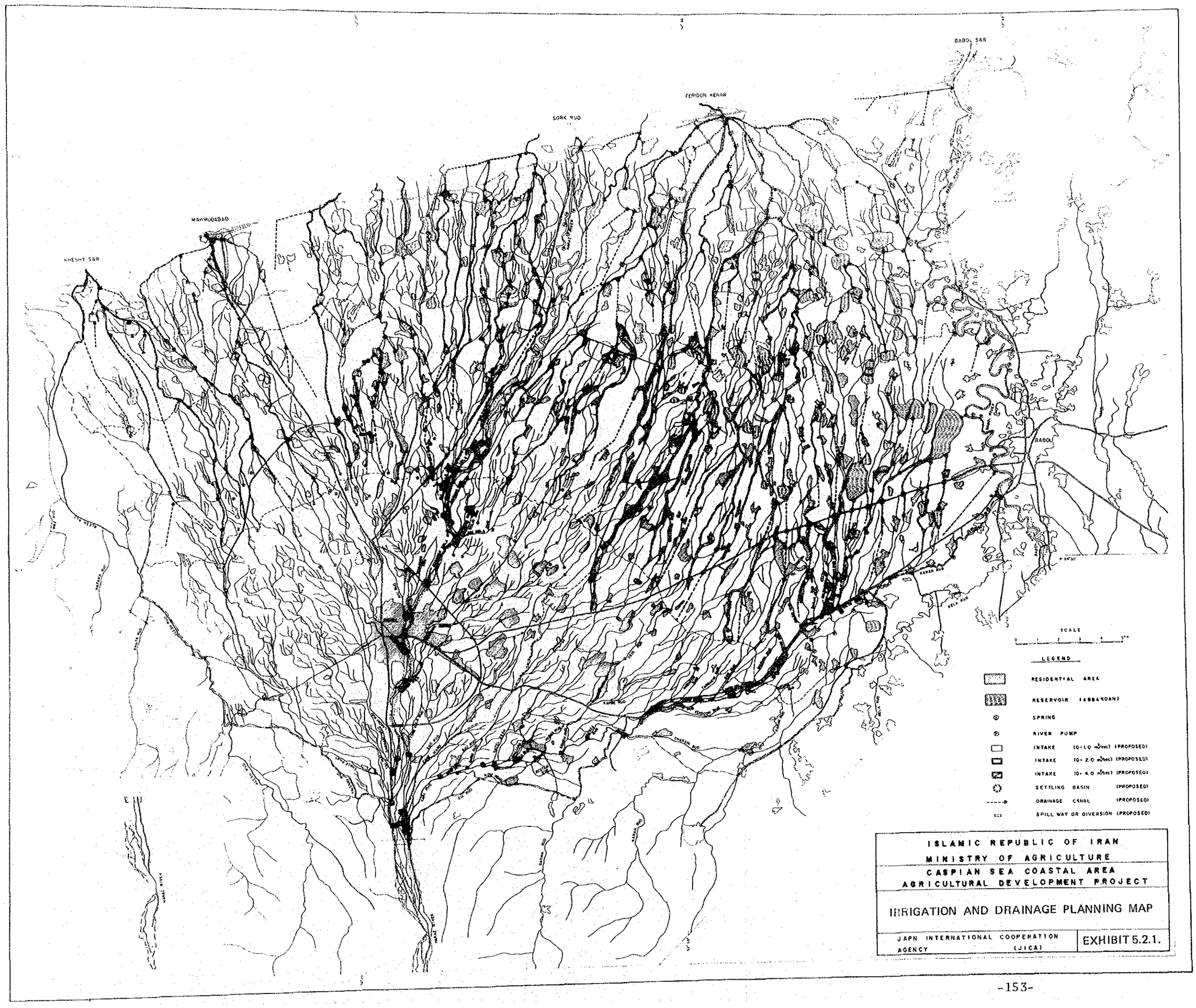


Figure 5.2.1 FLOW CHART OF WATER MANAGEMENT


BABOL SAR
FERDON KENAR
SORK RUD
MAHMUDABAD
KHESHT SAR
BABOL
SCALE
LEGEND
RESIDENTIAL AREA
RESERVOIR (SABBANDAN)
SPRING
RIVER PUMP
INTAKE (Q=1.0 m³/sec) (PROPOSED)
INTAKE (Q=2.0 m³/sec) (PROPOSED)
INTAKE (Q=4.0 m³/sec) (PROPOSED)
SETTLING BASIN (PROPOSED)
DRAINAGE CANAL (PROPOSED)
SPILL WAY OR DIVERSION (PROPOSED)
ISLAMIC REPUBLIC OF IRAN
MINISTRY OF AGRICULTURE
CASPIAN SEA COASTAL AREA
AGRICULTURAL DEVELOPMENT PROJECT
IRRIGATION AND DRAINAGE PLANNING MAP
JAPN INTERNATIONAL COOPERATION AGENCY (JICA)
EXHIBIT 5.2.1.

5.2.4. Land Consolidation

(1) Significance of Land Consolidation Works

The land consolidation aims, firstly, a comprehensive improvement of farmland conditions to modernize the agriculture by means of farm mechanization and, secondly, to formulate better rural environment as a part of improvement of environmental conditions at the rural area such as livelihood and natural features.

The Project Area has such characteristics as below:

1) Large scale expansion of farmland by means of reclamation of un-cultivated land (see para. 2.1 Present Land Use).

2) The yield/ha of paddy is currently high therefore a drastic increase of the yield/ha can not be expected.

To attain further improvement and stabilization of farm economy under such circumstance, it is necessary to increase cropping intensity and man-power productivity, therefore, the following land improvement works are to be carried out.

(1) Improvement of terminal irrigation networks (to stabilize the yield by means of timely irrigation).

(2) Improvement of terminal drainage networks (to increase the yield by means of application of intermittent irrigation method, to increase cultivable land for second crops draining the inundated water due to autumn-winter rain, and to increase operation efficiency of agri-machinery improving the bearing capacity of soil).

(3) Improvement of farm road networks (to avail access of agri-machinery).

(4) Rearrangement of farming plot (to increase operation efficiency of agri-machinery).

(5) Exchange of land (to increase the efficiency of farming works by means of grouping of scattered plots of paddy fields).

(2) Types of Land Consolidation

There are three types of land consolidation provided for the Project according to the level of improvement.

The basic planning and designing criteria adopted in consideration of experience in Japan and conditions in the Project Area are shown as follows: -

1) Drainage and irrigation canals should be separated at the terminal stage.

2) Size of a plot

Width : 30 meters - 60 meters
Length : 100 meters - 200 meters

3) Farm roads

Every plot should border on a road, and irrigation canals should run alongside the roads.

Interval	:	400 meters (200 meters x 2 blocks)
Total width	:	4.0 meters
Effective width	:	3.0 meters
Pavement	:	Gravel

4) Drainage canal

Every plot should border on a drainage canal.

1/10 daily probable rainfall 130 mm/day and daily drainage in a non-irrigation period are adopted as drainage planning standards for the introduction of the second crop.

5) Irrigation canals

Every plot should border on an irrigation canal.

A terminal irrigation canal, which supplies water to a plot directly, should be less than 600 meters in length.

Three types of land consolidation are provided depending on the degree of application of the above mentioned criteria.

Case-A : The criteria are applied entirely.

Case-B : The irrigation system is simplified in the criteria, i.e., plot-to-plot irrigation system is allowed.

Case-C : The size and shape of plots is not changed. The irrigation and drainage facilities and roads are improved but sometimes it is not possible to apply the criteria. The application ratio of the criteria is 70 percent for high priority facilities.

(3) Case Study of Land Consolidation in the Three Sample Areas

A case study was carried out in the three Sample Areas (High Land: Ejibar Kola, Middle Land: Barik Mahaleh, Low Land: Suteh). (Ref. to Appendix B.3.)

The outline of the case study is shown in the following table.

Table 5.2.8. Outline of Land Consolidation in Three Sample Areas

Items	Ejbar Kola (High Land)				Barik Mahaleh (Middle Land)				Suteh (Low Land)			
	Present	A	B	C	Present	A	B	C	Present	A	B	C
Facilities' Lot (%)	2.1	3.6	3.6	4.6	2.3	5.7	5.3	6.2	0.7	3.6	3.4	4.1
Mean acreage per lot (ha)	0.16	0.61	0.61	0.15	0.17	0.43	0.44	0.16	0.22	0.59	0.59	0.21
Road Density (m/ha)	48.6	54.0	54.0	58.2	50.8	84.2	84.2	50.8	7.5	33.2	33.2	37.7
Irrigation Canal Density (m/ha)	46.0	43.2	38.2	111.0	-	49.7	37.4	132.7	31.9	40.2	32.8	70.9
Drainage Canal Density (m/ha)	-	9.6	9.6	-	41.8	42.4	42.4	67.7	12.9	44.0	44.0	23.8
Project Expenses (x1000 Rial/ha)	-	528.9	520.4	290.9	-	587.1	568.6	386.2	-	463.4	451.9	207.0
Cost of Land Leveling (of total cost x1000 Rial/ha)	-	341.3	341.3	-	-	280.0	280.0	-	-	280.0	280.0	-
Economic Effect (%)	-	12.4	12.1	12.7	-	13.3	12.7	11.3	-	11.4	11.1	10.3

Note: 1. The above table shows the project expenses as of April 1986 which includes the overhead charge equivalent to 40%.
2. In computing the densities of irrigation canals, drainage canals and roads, those running along the boundaries of the Project Area are excluded.
3. The financial internal rate of return is shown in Table 5.5.3. and Appendix E.3 in detail.

As seen in the above table, the land consolidation of A-type is considered to be advantageous for the middle and low lands while that of C-type for the high land because in the high land the improvement of terminal facilities will not promise a great increase in yield since the high land hardly suffers from ill-drainage and shortage of irrigation water at present and as A-type needs a higher land levelling cost as compared with other two types. However, as the financial internal rate of return in case of A-type in the high, middle and low land in comparatively high at 12.1 %, 13.3 %, and 11.4 %, respectively, and separate irrigation and drainage system is an essential condition for introducing the highly productive agriculture, A-type land consolidation is adopted in the Master Plan although a detailed study shall be conducted in the stage of feasibility study.

(4) Procedures for Implementation of Land Consolidation

The following preparatory works shall be conducted after formulating the future plan of main irrigation and drainage networks based upon the basic concept of irrigation and drainage improvement mentioned in the paras. 5.2.2. and 5.2.3.

1- Setting up of working districts for land consolidation (standard block area of 110 ha), taking into consideration tertiary irrigation canals, drainage canals, and water sources (direct intake of canal water, possibility of supplemental use of abbandan water and groundwater, etc.)

2- Topographic survey of the land consolidation block and preliminary design of the block in accordance with the selected type of land consolidation in consideration of topography, size of the block, present land coverage of facilities, existing land use, etc.

3- Study on the standard construction cost and the benefits of the land consolidation based on the above 2.

4- Explanation of the objectives, and direct and indirect benefits of the land consolidation to the related farmers based upon the above 1 to 3. Use of audio-visual teaching materials is recommended, if necessary.

5- Explanation to the related farmers to obtain their common consent about the land loss, land substitution, construction cost to be borne by the farmers and group farming, etc. resulting from the implementation of the land consolidation, after confirming that the related farmers are active for its implementation.

6- Detailed design, construction cost estimate, and decision of cost burden by landowners based on the above 5.

7- Careful study and preparation of agreements for implementation of the land consolidation (covering the allocation, boundary and net area of farmland to be owned by each farmer after the land consolidation), the conditions of construction, and the construction plan based upon the above-mentioned detailed design.

8- Discussion with the related farmers for signing of the agreement for implementing the land consolidation among related parties. The detailed term and conditions of subsidy, loan and repayment as well as the accuracy in construction works, etc. shall be clearly written in the agreement.

The land consolidation should be implemented, in principle, in accordance with the application by the related farmers, i.e., beneficiaries. However, it is anticipated that the farmers do not understand fully the benefits brought about by the land consolidation in the initial stage. It is recommended to select the appropriate number of pilot areas, and carry out the guidance of farm management in these areas in order to demonstrate the benefits of land consolidation.

In implementing the pilot project, the same procedures as mentioned in the above 1 to 8 should be followed. A study on incentives such as higher subsidy rate should be made in consideration of the special role of pilot project.

Besides, for carrying out the land consolidation in a large scale and for a long term in the entire Project Area, it is necessary to establish institutions in parallel with implemention of the pilot project. The institutions should include land registration law for before and after the land consolidation and financial aspects such as for subsidy and loan.

5.2.5. Necessary Measures for the Land Improvement Scheme

For proceeding the land improvement scheme, the following measures are to be prepared:

- Reinforcement of the existing river gaging network.

  Stream flow observation has to be reinforced in the rivers concerned to flood intrusion and in the major irrigation and drainage canals as shown in Figure 5.2.1.

- Reinforcement of the existing meteorological observation network.

  Meteorological observation has to be reinforced to observe rainfall in the upper basin of the rivers concerning flood intrusion and in the project area as shown in Figure 5.2.1.

- Preparation of the topographic map and the Cadastral map (including water right) and reinforcement of the bench mark network.

- Soil survey including sub-surface groundwater table, hydraulic conductivity, percolation and soil bearing.

- Preparation of the irrigation and drainage network map and the Survey on irrigation area and water right.

- Survey of rivers on their profile and cross-sections of the Babol river, the Kari Rud, the Alesh Rud and the Haraz river below Razkeh village.

- Quantitative survey of floods and water shortage and damages by them.

- Survey of canals, abbandans and division works.

- Research on the effects by irrigation and drainage improvement and preparation of improvement criteria.

- Research on the efficiency of agricultural machinery by soil and by farm plot size, and preparation of improvement criteria.

- Preparation of the design criteria and the law for land consolidation.

- Training of the design engineers centering to land consolidation.

- Implementation of the pilot projects.

- Feasibility study and detailed design on the area drainage including flood control, the irrigation improvement and the land consolidation.

5.3. Agricultural Production Increase Scheme

At the establishment of a scheme for increasing agricultural production in the Project Area, the measure based on the existing agricultural basis and the measure to respond to the expecting land improvement scheme shall be studied. Namely, the implementation of land improvement scheme in the whole Project Area will need considerably a long period, and the improvement of cultivation practice responsible to the progress of such land improvement scheme shall be taken into consideration, but the increase of agricultural production based on the existing agricultural basis shall be attained in parallel, because such endeavourment will promise a higher productivity at the improvement of agricultural basis.

5.3.1. Target of Improvement of Cultivation Practice and Farm Management

The agriculture in the Project Area will be developed continuously centering around the paddy cultivation, therefore the improvement of cultivation practice of paddy is most important subject. Although the paddy cultivation in the Project Area has been reached at rather high level of production, it is not negligible that many problems are still remaining, e.g., the production cost is too high in comparison with other rice producing countries, furthermore the farmer's income is highly depending on the paddy cultivation and the employment opportunity to gain non-agricultural income is limited. Therefore, the target of improvement of cultivation practice and farm management shall be to bring the production cost of rice near to the international level without decreasing the income level of farmer conquering such present conditions as mentioned above. And, the following points are shown as the concrete targets which response to the problem;

(1) Appropriate Production Cost

As explained in the above para. 2.5.2, the production costs of paddy per hectare are estimated 450,858 Rls. for Amol-3 and 402,457 Rls. for Tarom. Assuming that the average yield of Amol-3 and Tarom as 6.7 t/ha and 3.5 t/ha respectively (re. para. 5.3.1.(2) below), the production cost of paddy per ton become 67,292 Rls. and 114,988 Rls. On the other hand, the average price of imported rice in 1358 was about 40 Rls. per kilogram of unpolished rice, therefore the converted price of paddy becomes about 28,000 Rls./t. Considering the fact that the international market price of rice has been stabilized in the recent years, extraordinarily high production cost of Iranian rice becomes clear.

The largest reason making such high production cost is considered for the labor cost of 347,149 Rls. in case of Amol-3 and 307,997 Rls. for Tarom, which are sharing about 77% of production cost in both cases.

To bring the production cost of Iranian rice near to the international market price, decrease of ratio of such labor cost in parallel with increase of yield/ha becomes indispensable conditions, and the appropriate production cost shall be computed from the potentiality of improvement of these 2 factors.

(2) Increase of Yield/ha

From the mode analysis of the results of yield survey by the MOA, the mean yield of Amol-3 and Tarom are estimated as 6.7 t/ha and 3.5 t/ha respectively, and there are not any clear difference by the district or by the year, but there are rather clear secondary mode of 8.4 t and 4.2 t, therefore those figures may be applied as target value of yield increase.

The reason of comparatively large difference between first and secondary modes as 25.4% and 20.0% respectively is assumed mainly due to difference of farming practice by each farmer. Therefore, considerably high rate of yield increase will be expectable by mean of improvement of farming practice and its extension to the farmer even if the improvement of agricultural basis related to solving poor drainage, shortage of water, etc. are delayed.

Note: As for present and target value of yield, further study is necessary because of insufficient available data thereto both for qualitatively and quantitatively. Especially, as for Amol-3, yield of nearly 10t/ha has been confirmed as the results of detailed field survey in 1365, however, the aforementioned target value of yield is applied in this Master Plan considering that the Amol-3 is selected as representative variety of high yielding varieties in this study, and it may be replaced to Haraz which has better quality than Amol-3.

(3) Decrease of Labor Cost

As explained in the above para. 2.5.2, the largest portion of labor demand by works is harvesting work in both cases of Amol-3 and Tarom, and sharing 25.8% and 28.7% of total labor demand respectively. In case of Amol-3, Weeding (18.9%), transplanting (15.1%), plowing (13.9%) and threshing (9.9%) are followed to the harvesting works, but that of Tarom is in order to transplanting (16.5%), weeding (15.6%), plowing (10.9%) and threshing (10.3%). Therefore, the mechanization of harvesting work will influence 35.7% for Amol-3 and 39.6% for Tarom. The mechanization of transplanting will influence the weeding works as well, therefore it will relate to 34.0% and 32.1% of labor demand respectively.

In the existing agricultural basis, the mechanization of paddy culture is hardly possible because of 2 main factors of lack of farm road and poor drainage, and, especially, the former is whole area problem. From such point of view, the decrease of labor cost will become possible by mean of implementation of land improvement works.

(4) Through-the-year Farming Works

The present farmer's income is, as explained in the above para. 2.5.1, depending on the agricultural income of paddy cultivation in the rate of more than 85%. On the other hand, the family labor converted to adult male as 1.0 is 946 hours for Amol-3 and 824 hours for Tarom, and the farmer who possesses 1.0 - 5.0 ha of land is gaining about 730,000 Rls./ha of income. Considering the fact that the urban worker of the same level income ought to work about 2,000 hours/annum, the hourly value of work of paddy cultivation farmer is more than twice of urban worker. Although the special character of farming works shall be taken into account, the working hours of farmer is to be increased to decrease labor value without decreasing the farmer's income, and the introduction of the second crops and encouragement of livestock farming are considered as a possible measure. For instance, the labor value will be decreased at 25% if average income increased by 50% by means of doubling the working hours.

The methods to achieve such target are verified in the following paragraphs.

5.3.2. Land Use Plan and Proposed Cropping Pattern

(1) Land Use Plan

Land use plan is presented on the following premise.

1) Existing cultivable land like reservoir (abbandans) and forest are not to be reclaimed.

Reservoirs are indispensable for supplemental irrigation water and have been served for fishing by many of inhabitants in the vicinity of them. In addition, the area drainage plan explained in para. 5.2.2 proposes to use reservoirs effectively as retarding basins other than regulating irrigation water therein.

On the other hand, forest is to remain as a space for social and welfare function such as preservation of scenery, though its economic productivity is low. Forest also has a possibility as sites for building the facilities of welfare and industry in the future.

Furthermore, from a viewpoint of water resources, since present cropping area of paddy has already reached almost the limit so as to increase the cropping ratio of improved varieties, the existing cultivable land should not be reclaimed in principle in the Project Area. When surplus of water resources has been born because of decrease of paddy area due to expansion of residential area in the future, the surplus is considered to be utilized principally for dissolving water shortage in the vicinity rather than for use in the Project Area.

However, the existing cultivable land is to be studied for its more effective utilization investing them with necessary improvement, not remaining as present. (refer to the para. 5.3.6.)

2) Fallow and waste land scattering in the paddy cropping area will be involved into the consolidated land when the land consolidated works are undertaken. As a result they will be converted to cultivated land.

3) Upland fields are excluded from this study because, in general, they are scattering in small size at the well-drained areas surrounding residencial areas, and there are few farmers who are planting only upland crops.

4) In most portions of the middle and low land, the completion of drainage improvement works will make introduction of second crops be possible and, consequently, avail the application of high cropping intensity therein.

The area occupied as paddy fields is about 73,000 ha, however, actually cropping area is estimated to be approximately 68,000 ha and the remainder is regarded as fallow and waste land. The land which will be occupied with on-farm-facilities at the implementation of land consolidation works is almost equal to that of existing fallow and waste land which will become as cultivated land after land consolidation.

Present and future cropping areas of paddy by sub-area are shown in Table C.1.5 of Appendix.

(2) Proposed Cropping Pattern

Proposed cropping pattern in the Project area is basically composed of two patterns shown below by introduced varieties of the second crops.

(a) Paddy-berseem-paddy-berseem
(b) Paddy-berseem-paddy-winter vegetables

(a) is applied in the whole area and (b) is applicable mainly in the high land. The cropping pattern (a) is planned in 50% of whole Project Area considering the forage supply for livestock farming, and the other is projected in 10% of high land. Consequently, future cropping intensity will become 160% in the high land and 150% in the middle and low land respectively (See Figure C.2.3 in Appendix) the cropping intensity of whole Project Area will be 153%.

Proposed second crops in the Project Area are selected taking the factors mentioned below into consideration.

1) Agricultural development plan in Five Year Plan. (1362 - 1366)

2) Natural conditions of the Project Area.

3) Needs and marketability of crop production.

4) Intention of farmer for introduction of the second crops.

5) Cultivated crops at present.

Berseem is one of the twelve crops which are included in the production increase scheme of the Five-Year Plan and is now recommended by GDA of Mazandaran. On the other hand, according to farm economic survey, intention of the farmers for planting berseem is strong compared with other crops and also berseem has been already grown to some extent in the Project Area.

Winter vegetables such as broad bean (immature), lettuce, spinach and radish have been cultivated in the Project Area, especially in the high land and some portion of the production has been sold to such large cities as Tehran. It is expected that incremental production due to successful implementation of the Project will be transported to Tehran and so forth, after the improvement of the marketing system.

Such crops as potato and onion of which supply amount is not satisfied with their demand in the Project Area, are not planned as second crops, for there are some areas where above crops have been extensively produced in large scale fields in Mazandaran Province.

Besides berseem and winter vegetables, it is considered that barley and rapeseed (Colza), as one of oilseed crops recommended in aforesaid Five-Year Plan, will be acceptable as a second crop from the viewpoint of physical conditions such as weather. Barley has been cropped in the Project Area in a small scale, and rapeseed, however, is not planned as one of introduced second crops in this study since the crop has not yet cultivated in the Project Area. It is suggested that the possibility of introduction of these crops is to be studied as one of the themes of agricultural research and experiment.

Note: In case the introduction of barley, rapeseed, etc., the cropping pattern and cropping intensity will be revised, however, the basic direction of introduction of Berseem in 50% of cropping area is applied in this Master Plan from the viewpoint of security of forage resource in the Project Area.

(3) Production Plan

As for paddy, the optimum ratio of cropping area is set forth as follows due to limitation of water resources.

Local variety : Improved variety = 2:8

Apart from broad bean, cropping area of each winter vegetable is planned in accordance with the existing ratio of each cropping area.

Cropping area of broad bean is planned to be as much as existing area due to low productivity.

Yield of paddy is assumed taking the present yield and expectable improvement of cultivation practice in future into account. On the other hand, yield of each winter vegetable is projected taking into consideration the yield achieved by progressive farmer in the Project Area.

In the high land, yield of paddy of "without Project" is assumed to reach the same yield of "with Project" owing to the present favorable irrigation and drainage conditions.

Table 5.3.1. Yield of Projection

Crop	Present	Without Project	With Project
Paddy			
Local variety (a)	3.5	4.0*	4.2
Improved variety (b)	6.7	7.7**	8.4
Winter vegetable (c)			
Lettuce	12	30	30
Spinach	10	20	20
Radish	12	25	25
Broad bean	4	6	6

Note: (a): Tarom represents the local variety.
(b): Amol-3 represents the improved variety.
(c): Present yield of winter vegetables is assumed from Village Survey - 1364.
* .. High Land 4.2, Middle and Low Land 3.9
** .. High Land 8.4, Middle and Low land 7.4

Production of "with Project" as well as "without Project" are shown in Table 5.3.2.

As for berseem, it is explained in the para. 5.3.5 of "Improvement of Animal Husbandry".

Table 5.3.2. Crop Production with and without Project

Crops	Without Project			With Project			Incremental Production (2) - (1)
	Cropping Area (ha)	Yield (ton/ha)	Production (1) (ton)	Cropping Area (ha)	Yield (ton/ha)	Production (2) (ton)	(ton)
High Land							
Paddy	18,717		112,301	20,007		134,048	21,747
Local Variety	7,487	3.9	29,199	4,001	3.9	15,604	Δ13,595
Improved Variety	11,230	7.4	83,102	16,006	7.4	118,444	35,342
Winter Vegetables	610		4,800	2,001		40,887	36,087
Lettuce	20	30	600	573	30	17,190	16,590
Spinach	20	20	400	303	20	6,060	5,660
Radish	20	25	500	573	25	14,325	13,825
Broad bean	550	6	3,300	552	6	3,312	12
Middle Land							
Paddy	27,229		163,376	26,737		202,130	38,754
Local Variety	10,891	3.9	42,475	5,348	4.2	22,462	Δ20,013
Improved Variety	16,338	7.4	120,901	21,389	8.4	179,668	58,767
Winter Vegetables	305		1,830	306		1,836	6
Broad bean	305	6	1,830	306	6	1,836	6
Low Land							
Paddy	21,039		126,232	20,826		157,445	31,213
Local Variety	8,416	3.9	32,822	4,165	4.2	17,493	Δ15,329
Improved Variety	12,623	7.4	93,410	16,661	8.4	139,952	46,542
Total							
Paddy	66,985		401,909	67,570		493,623	91,714
Local Variety	26,749	3.9	104,496	13,514		55,559	Δ48,937
Improved Variety	40,191	7.4	297,413	54,056		438,064	140,651
Winter Vegetables	915		6,630	2,307		42,723	36,093
Lettuce	20	30	600	573	30	17,190	16,590
Spinach	20	20	400	303	20	6,060	5,660
Radish	20	25	500	573	25	14,325	13,825
Broad bean	855	6	5,130	858	6	5,148	18

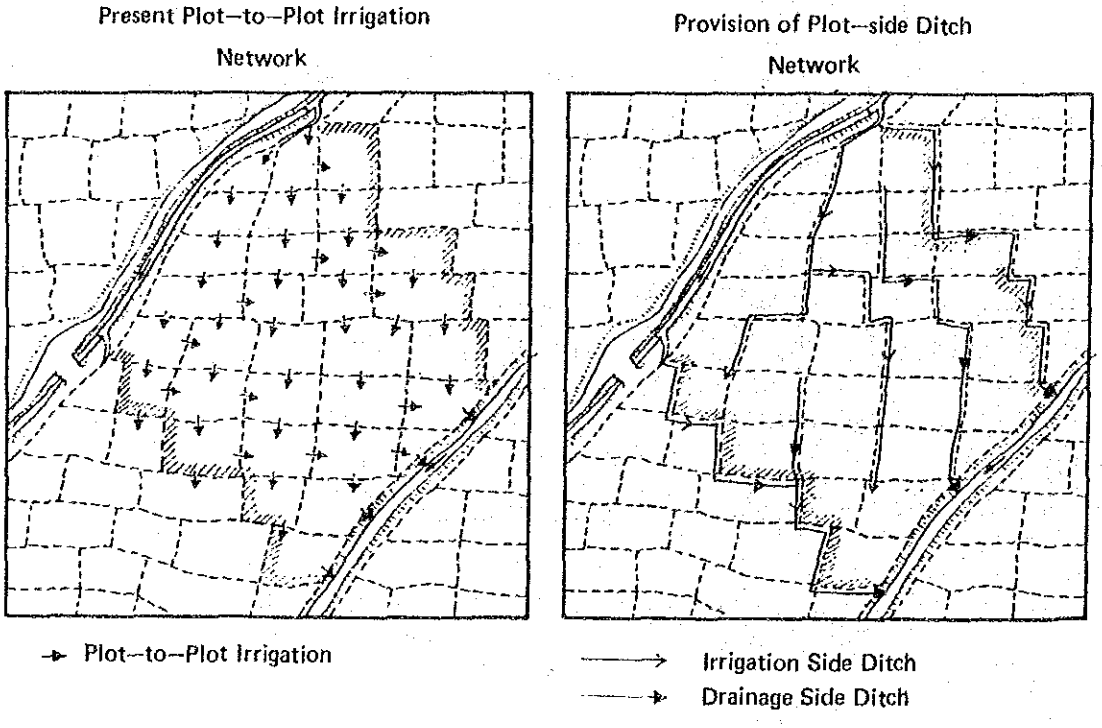
5.3.3. Improvement Measures for Farming Practice/Farming Management

(1) Improvement Required at Present

The improvement of paddy cropping techniques which can be made at present as countermeasures to the problems mentioned in the previous paragraph 4.4.4. are enumerated below; (The improvement will also contribute to the smooth upgrading of the present paddy cropping techniques to the level necessitated in farm management after the land consolidation. As premises for the improvement, the following land improvement shall be promoted at individual farmers' level.

i) To enlarge the present extremely small farm plots (0.01 ha or less) as much as possible.

ii) To provide the present paddy field with the plot-side ditch networks so that the water management can be made independently for each farm plot covering irrigation, drainage, and water depth in the farm plot. In constructing the plot-side ditch networks, the irrigation ditches and drainage ditches shall be separated to the maximum extent possible. Irrigation ditches shall be diverted from a present terminal irrigation canal while drainage ditches shall be extended to an existing terminal drainage canal. The following figures compare the present plot-to-plot irrigation and the proposed irrigation with plot-side ditch networks.



1) Seedling Raising

i) Renewal of seeds

ii) To keep practising seeds disinfection (countermeasure for rice blast)

iii) Extension of high land nursery beds (for raising healthy seedlings)

iv) Encouragement of thinly seeding (for raising healthy seedlings)

v) Raising seedlings by protection nursery for preventing seedlings from cold injury in case of early seeding from the end of March to early April.

vi) Encouragement of thorough weeding in nursery beds, particularly panium Crus-Galli L.

2) Preparation of Paddy Fields

i) Review of present fertilization criteria. Establishing the fertilization criteria by variety and by sub-area, and extending the criteria exhaustively.

ii) Basic study/research are required on efficacy of potassium fertilizer.

3) Transplanting

i) Transplanting of healthy and proper age seedlings.

ii) Regular transplanting shall be practised for homogeneous growth of plants and increase in farming work efficiency.

iii) Review of appropriate planting density. Further study will be able to improve the planting density for increasing yield.

4) Varieties

i) Introduction of new varieties shall be initiated by the related research institutes by giving thorough knowledge and information to farmers on specific features and necessary cropping techniques of new varieties.

ii) Other local varieties than Tarom have been still grown in the Area. It is necessary to establish the appropriate cropping techniques for these local varieties so as to make better use of their specific features.

5) Water Management

i) The adequate water management to meet the respective growing stages will be necessary, and the aforesaid plot-side ditch networks are essentially required for the purpose.

° Deep water period (5 - 10 cm): From transplanting to rooting stage, during formation of young panicle, and from booting to heading stages.

° Shallow water period (3 - 5 cm): From rooting to maximum tillering stages.

° Intermittent irrigation period: Young panicle growing stage, ripening stage.

° Drainage for harvesting: 10 - 20 days before harvesting

ii) Water management for weeding: Refer to paragraph on "Weeding".

6) Top Dressing

i) Top dressing shall be securely practised within 20 days after transplanting.

ii) After the above top dressing period, top dressing shall be made by judging the colors of plant leaves. The top dressing, if judged to be necessary even after the aforesaid period, should be made after young panicle formation.

iii) DAP fertilizers shall not be used as phosphoric acid for top dressing.

7) Weeding (Use of herbicides)

i) Ronstar shall be used as the herbicide for early stage of growing. Successful Ronstar spraying, if carried out before puddling, will require levelled field surface and deep ponding water for two - three days, and also require two - three day deep ponding even after transplanting. Flowing irrigation shall be never carried out for those periods of herbicides spraying.

ii) Satarn, used as herbicide also for early plant growing, kills Panicum Crus-Galli L selectively. Spraying of this chemical shall be made before one-leaf stage of Panicum Crus-Galli L mullets, since the efficacy will decrease after that stage of Panicum Crus-Galli L mullet growth. Successful Satarn spraying also requires three - five day deep ponding water.

8) Disease and Pest Control

i) The disease and pest forecast system shall be firmly established and enhanced.

ii) Healthy paddy plant growing. For the purpose, the fertilizers shall be dosed in reasonable proportion of the three elements and the delayed top dressing shall not be made in the latter part of plant growth.

iii) The agri-chemicals dosing shall be practised carefully, taking into consideration the adversely effects on human body and living environment in misuse. For example, DDT and Linden, the organic chlorine, will serious effect human body. These chemicals, therefore, shall be replaced by other chemicals such as Diazinon which is dosed presently, MEP, MPP and CVMP.MTMC.

(2) Improvement Measures After Land Improvement

In addition to the above-mentioned improvement measures, the totally mechanized farming can be applied for further improvement after land improvement. On top of the above, the drainage improvement will permit to introduce a large-scale second crop into the Area.

From viewpoints of cropping techniques and water management for paddy field, it is necessary to extend the improvement mentioned in the above para. (1) "The Improvement Required at Present" to the entire Project Area. Particularly, adequate water management has to be carried out so as to meet the respective growing stages irrigation/drainage and water depth control, because the land consolidation enables farmers to control water as required at individual lots.

1) Present Stage of Mechanization for Paddy Farming Works

As for the mechanization system for paddy farming works in the Project Area, the use of tiller for plowing and leveling of paddy field has become popular since 1340's and that of threshing with tiller engine has become popular since the beginning of 1350s. Namely, the mechanization system for paddy farming works at present is on the stage that may be said for the mechanization system based on tiller, so that the transplanting and harvesting works which require great labor and compel physical pain still rely on human powers. Because of both works, farmers require much family labour and hired labour. As the Farm Economic Survey has already shown, labour requirement for paddy farming works amounts to 1,274 hours in Amol-3 and 1,119 hours in Tarom per hectare, and labour requirement for the above two workers share 521 hours and 506 hours respectively, or 41 to 45% of total labour requirement.

Hired labour for the above two works shares higher percentage of total hired labour. It is required 261 hours in Amol-3 and 216 hours in Tarom, or 72 to 73% of total hired labour requirement.

The operating hours of agricultural machines in paddy farming works are mainly those of tiller, which are estimated at 135 hours for Amol-3 and 111 hours for Tarom per hectare.

2) Objective of the Farm Mechanization for Paddy Cultivating Works and Its Phased Introduction

It is not necessary to say that the main objective of farm mechanization for paddy cultivating works is to save labour requirement and to reduce paddy rice production cost through replacing manpower with machine-power. Furthermore, the farm mechanization for paddy cultivating works aims to lower the protuberant peak working hours in the busy season of paddy cultivation, to conduct the agricultural multi-management by the aid of spare family labour, and to scheme the increase of agricultural production through the intensive use of family labour and land resources. Moreover, another objective is to convert spare family labour into constant non-agricultural labour, too.

As for the farm mechanization system for paddy cultivating works in the Project Area, 3 types, that is, small, medium and large capacity mechanization system are considered as shown in Table 5.3.3. (1).

The small type is based on the present tiller type system. The point which this type differs from the present one is to mechanize both transplanting and harvesting works that have been a big obstacle to reduce the rice production cost which shares to 41 to 45% of total labour requirement and 72 to 73% of total hired labour, introducing relative working machines such as transplanter and combine. This system is to be accompanied with the cooperative preparation of nursery facilities which supply the seedling for transplanter and the country-elevators which become necessary in order to harvest and thresh the paddy with combine.

The medium type is the mechanization system which applies a medium capacity tractor of 20-30 Hp as power source, which will be introduced after the improvement of land condition through drainage improvement and land consolidation works. This type of the mechanization system will avail to enlarge transplanters and combines (self-running type) according to the capacity of working machines. Namely, this is the mechanization system which has parted from the present tiller type farm mechanization

system, and which plunges into the stage of tractor type farm mechanization system for paddy cultivating works. At this stage, the possession of machines by a person or a small group at present will be obliged to shift to that of the organized group, and the farming management will also be changed toward that of the mechanized farming group. The progress of such grouping will influence of the application of the medium type mechanization system. The large type mechanization system is the system which raises horsepower of tractor further and adopts working system with this power.

As for the farm mechanization for paddy cultivating works in the development of Project Area, the small type mechanization system should be introduced at the beginning, owing to the prevailing situation of inner and outer circumstance surrounding the agriculture in the Project Area such as the farm economic situation, the prevailing standard of cultivating practices, availability of farming machines, problems on employment, the actual situation of agricultural research and experiment institutes and extension services, the financial problems of the country, etc.

On the small type mechanization system, the expected labour requirement will be 746 hours per that of 1,274 hours at present for Amol-3 and 612 hours per 1,119 hours at present in case of Tarom. As the result of the above, the rice production cost will be reduced to 393,000 Rls. against 451,000 Rls. at present for Amol-3 and to 326,000 Rls. per 402,000 Rls. for Tarom.

Furthermore, it is shown in Figures C.4.1 and C.4.2 of Appendix C, that the introduction of small type mechanization system in the Project Area will bring the leveling of labour requirement for paddy cultivating works and the improvement on supply and demand balance of farming labour throughout the Project Area.

The leveling of labour requirement for paddy cultivating works and the improvement on supply and demand balance of farming labour will opportunately give the paddy cultivating farmers a possibility to introduce agricultural activities which must be managed constantly throughout the year. For instance, the animal husbandry as its greatest one, and a possibility to take one more step toward the intensive use of land and the better use of farming labour in the Area.

Table 5.3.3.(1). The Farming Mechanization System for Paddy Cultivating Works

Mechanization System		Small Type	Medium Type	Large Type
Power Machines		tiller(7-10Hp) or small capacity tractor (10-15 Hp)	Medium capacity tractor (20-30 Hp)	large capacity tractor (40-60 Hp)
Working Machines	Nursery preparation	cooperative nursery facilities	cooperative nursery facilities	cooperative nursery facilities
	Fertilizing	man power	shoulder type duster and granule applicator trailer (1t)	broad caster (200 lit) trailer (2t)
	Plowing	rotary(0.9m)	rotary(1.2m)	rotary (1.8m)
	Levelling Puddling	paddy wheel attached to tiller	paddle machine (1.2m)	paddle machine (1.8m)
	Transplanting	transplanter (2 rows plant) (self-running)	transplanter (4 rows plant) (self-running)	transplanter (6 rows plant) (self-running)
	Weeding	herbicides (manual spraying or shoulder type power sprayer	herbicides (shoulder-type power sprayer)	herbicides (power sprayer)
	Spraying	shoulder-type sprayer by man-power or shoulder type power sprayer	shoulder-type power sprayer	power sprayer
	Water-management	manual control	manual control	manual control
	Harvesting	combine or binder (2 rows reap) (self-running)	combine (4 rows reap) (self-running)	combine (4 rows reap) (self-running)
	Transporting	trailer(0.3t)	trailer (1t)	trailer (2t)
	Milling	country-elevator	country-elevator	country-elevator

Note: (1) Regarding the Cooperative Nursery Facilities

i) Each cooperative will be equipped with proper units of the aforesaid facilities for cooperative nursery, and the cooperative will be responsible for operation and management of the facilities.

ii) The farmers order the cooperative their required quantity/varieties of seedlings, then the cooperatives produce the seedlings to meet the farmers requirement.

iii) The scale and details of facilities shall be so determined as to meet the orders from the subscribing farmers. Seeds shall be supplied from the governmental seed multiplication fields or the fields of the farmers who are entrusted seed supply.

- Seed Selection Equipment (Winnowing and Specific Gravity Selection)
- Tanks for Seed Soaking & Disinfection
- Pregermination Room (with devices to give moisture and temperature)
- Seedling Boxes (30cm x 60 cm x 3 cm), to prepare 200 boxes to cover 1.0 ha (to be collected after transplanting)
- Nursery Beds and Devices for bed soils preparation so as to crush soils into fine particles and to mix with fertilizers.
- Filling boxes with soils -- Compaction -- Seeding Soil covering -- Watering (Devices for consistent works)
- Germination Room (Giving Moisture and Temperature)
- Greenhouse (Vinyl sheet-covered house)
- Hardening House (Vinyl sheet-covered house with freely closing/opening ceiling system)
- Appurtenant Facilities, Working Room, Warehouses, Control Room.

iv) Hardened seedlings shall be delivered to the farmers

(2) The shoulder type motor-sprayers for fertilization shall be used for top dressing and pest control as well.

(3) Transplanting machines shall be used for transplanting of young seedlings.

(4) Lime sowers would work more efficiently for spraying materials with plasticity such as lime, calcium cyanamide, etc. for fertilization.

3) Mechanization of Second Crop Farming

The second cropping in drained fields and its mechanized farming system will vary by kinds of crops to be introduced. And the mechanized farming system for second crops based on berseem as the most promising crop is shown in Table 5.3.3. (2).

This mechanized farming system premises soiling berseem. In case of drying berseem and storing it as silage, the system requires additional machinery for this process. The measure for this process is mentioned in the para. 5.3.5.

Table 5.3.3.(2). The Farming Mechanization System for Second Crop Cultivating Works (Berseem)

Kinds of Works	Mechanization by Small-size Machines	Mechanization by Medium, Large-size Machines
Powered Equipment Operation	Tillers (7 - 10 PH)	Medium-size tractor (20 - 30 PH)
Plowing Soil Crushing	Rotary (Tiller Attachment)	Rotary (Tractor Attachment)
Seeding	Manual Seeding or Granule Applicator	Power Sprayer for Powder or Granule
Dressing	Manual Spraying or Granule Applicator	Power Sprayer for Granule/Broadcaster
Harvesting (Soiling)	Small-size Mover (Tillers Attachment)	Forage Harvesters (Tractor Attachment)
Hauling	Small-size Trailors (Tiller Attachment)	Trailor (2 t) (Tractor Attachment)

5.3.4. Measurement for Post-harvesting Improvement

In case the harvesting works are mechanized as a part of introduction of mechanization system of paddy cultivation in the Project Area, the improvement of post-harvesting treatment is also required inevitably. Namely, the drying of paddy and husking are to be performed by means of introduction of country-elevator or other similar facilities. But, first of all, the problem of where and how to install such facilities in relation with existing rice mills shall be solved. Moreover, the actual yield rate of whitened rice is considered rather low under the present rice milling practice, therefore, improvement of such practice will mean actual increase of rice production. Furthermore, the marketing of produced rice shall be done by the farmer under the present contracting rice milling system, therefore the small scale farmer is often obliged to accept unfavourable dealing. Those problems are to be studied comprehensively and suitable measurement shall be established in the soonest opportunity.

Presently, whole paddy production in the Project Area is polished at the private rice mill. Each rice mill has 25 - 40 t/day installation capacity, and the scale is very small and the workability is poor, but the improvement of such condition shall be done carefully taking into consideration the fact that the rice milling is the most important industry in the Project Area having about 280 mills and employing some 1,500 workers at the busy time. Moreover, parts of rice milling facilities have been manufactured in the country contributing to the promotion of industrialization. Therefore such approach as to simply replace the facilities with imported advanced facilities is not recommendable.

The measure of improvement of rice milling in the paddy cultivation zone centering the Project Area is required after recognition of its actuality with the surrounding situation to improve the quality and to respond to the demand arising from the mechanization of harvesting works, and such requirement is examined from viewpoints of improvement of existing facilities and of introduction of new facilities.

(1) Improvement of Existing Rice Milling Facilities

The subjects of improvement of existing facilities are as following:

Facilities	Manner of Improvement	Present Conditions
1. Building & Yard		
° Yard	(a) Expansion/Levelling	° Difficult pass of vehicle
° ditto	(b) Asphalt pavement	° Mud or Gravel
° Paddy stock	(c) Expansion/Water proof	° Out door with vinyle sheet cover when rain
° Inside of mill building	(d) Water proof/wet free	° Leakage of rain/non-ventilation system
° ditto	(e) Pavement of floor	° Dirt floor/unevenness
° Rice stock	(f) Expansion	° Mixture with paddy/ non wet control
2. Milling Facilities		
° Paddy Dryer	(g) Replacement	° High heat-rapid dryer
° ditto	(h) Add heat agitator	° Uneveness of drying
° Paddy husker	(i) Control of rubber roll	° Non-dehusked paddy
° ditto	(j) Add separator of non-dehusked paddy	° Dehusking at whitening process causing much broken rice
° Rice whitening machine	(k) Control of friction power	° Produce broken rice & powdered rice
° Total system	(l) Combination of capacity	° Lowering mill's efficiency
3. Appurtenant Facilities		
° Weighing of Paddy/Rice	(m) Installation	° Not weighing at all
° ditto	(n) Carry-out weighing both paddy & rice	° One of paddy or rice is weighed
° Water Content Tester	(o) Installation	° Not used at all
° Rice Grader	(p) Installation	° Partly installed
° Bran stock	(q) Installation	° Take off with bag
° Husk stock	(r) Improvement	° Blow out/no arrange
° Fire protection	(s) Installation	° Not installed/often firing occurrence

Taking these conditions into account, the types of rice mill by degree of improvement are classified as below;

Building & Yard							Milling Facilities							Appurtenant Facilities							
	a	b	c	d	e	f		g	h	i	j	k	l		m	n	o	p	q	r	s
I	-	-	-	-	-	-	A	-	o	o	o	o	-	U	-	o	o	-	o	-	o
II	-	-	-	-	-	o	B	-	o	o	o	o	o	V	-	o	o	o	o	-	o
III	-	o	o	-	-	o	C	o	-	o	o	o	-	W	-	o	o	o	o	o	o
IV	o	o	o	-	-	o	D	o	-	o	o	o	o	X	o	-	o	-	o	-	o
V	o	o	o	o	o	o								Y	o	-	o	-	o	o	o
														Z	o	-	o	o	o	o	o

o ... To be improved
- ... Present condition is acceptable

The standard combination of above factors in the Project Area are classified as below;

(1) I A U, I C U — Recently established comparatively large scale mill

(2) II A/B U, III C/D V/W — Comparatively large scale mill established in 1350s or recently established small mill

(3) IV A/B W, IV C/D W — Most of existing mills are this type

(4) IV A/B X/Y, IV C/D X/Y — Many of those mills established in 1340s

(5) V A/B W/Z, V C/D Z — Many of those mill established before 1344.

Amongst the above types, the type (5) is considered to be replaced as superannuated facilities, but some measures for improvement are to be considered for the types (1) - (4).

(2) Introduction of New Facilities

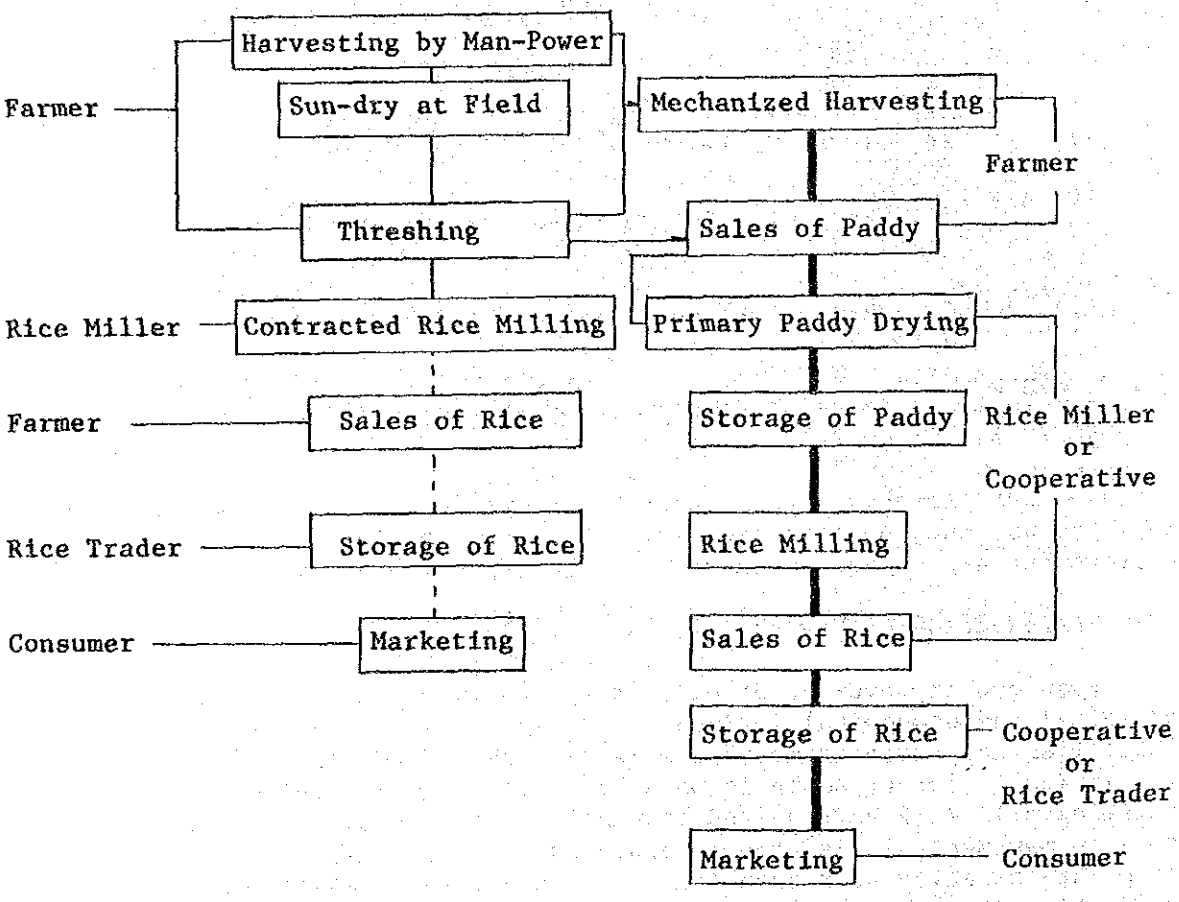
Even the improvement of existing mills is recommended because of social and economical influence. However, the defect of existing facilities can not be removed completely, so introduction of new facilities in larger scale in parallel with consolidation of existing mill will be required gradually. To give proper impact on to such movement, it is recommendable to introduce new facilities with such capacity as responding to the expecting quantity of production increase in future. Furthermore, it is favorable that the new facilities are operated by the rural cooperatives to activate the rural cooperative activities.

(3) General Problems on the Post Harvesting

In case of mechanized harvesting of paddy, the packed paddy will have water content of more than 20% because the sun dry application is hardly possible. Therefore, the harvested paddy shall be dried immediately after the harvesting to control the water content for preventing the degeneration of quality. In case of new facilities, such procedures will take place by mean of introduction of country-elevator and/or other system, but in case of existing rice mill, the quick drying with the existing paddy dryer will be hardly possible. Moreover, the paddy shall be dried by each lot of the clients under the present contract basis milling system, and, consequently, the working efficiency will be fallen down considerably.

Considering the aboves, a fundamental improvement of post harvesting procedure including the paddy-dealing system will be required in the future.

The post harvesting procedure in the Project Area will be proposed as below;



Final line ▬▬
Transition line ——
Tentatively line (present system) - - -

If the paddy-dealing system is applied between the farmer and the rice miller, the rice miller will be obliged to endeavour the increase of rice/paddy yield rate, and, as the result, the decrease of rice milling loss will be expected. Furthermore, the price of paddy and rice will be controlled through the pricing of cooperative operating rice mill.

5.3.5. Improvement of Animal Husbandry

(1) Countermeasures for the Livestock Improvement

It is unavoidable for the animal husbandry in the Project Area to depend upon rice straw and other by-products of paddy taking into consideration the present agriculture of paddy mono-culture but the farmers generally might not understand the importance of nutrient value of forage crops; therefore, comparative table of roughage's nutrient values are shown for reference.

Feeds	Ration (kg/day)	Nutrients Content (%)		Amount of Nutrients		Increase and Decrease to the Standard	
		DTP	SV	DTP(g)	SV(kg)	DTP(g)	SV(kg)
Rice Straw	8.6	0.6	20.1	52	1.7	- 198	- 0.7
Hay on Levees	8.6	3.4	26.7	292	2.3	+ 42	- 0.1
Hay of Wild Grass	8.6	1.0	18.6	86	1.6	- 164	- 0.8
Berseem Hay	8.6	11.5	40.8	989	3.5	+ 739	+ 1.1

Note: DTP: Digestible True Protein
SV : Starch Value
Standard requirement of nutrients for maintaining body was decided considering female cow (500 kg of live body weight) as 250 g/day of DTP and 2.4 kg/day of SV.

The above table indicates that 8.6 kg of berseem hay per day can meet nutrient requirement for maintaining animal (500 kg/head) healthy, and on the contrary, it is difficult for cattle to keep healthy condition by feeding rice straw and wild grass hay only. Therefore, some other supplemental feeds must be given to the animal.

The feeding practised in the Project Area has been traditionally dependent upon rice straw and wild grasses. But sheep and goats are also grazed in natural grasslands, and consequently, both of them cannot be grazed enough to meet standard nutrient requirement and this has resulted in low productivity of animal.

However, it will be possible to improve these feeding circumstances and low productivity by diffusion of berseem cropping as the second crop. For example, if milk production ranges from six to 15 kg per day, berseem can meet nutrient requirement for the milk production and body maintenance, and this means the advantage of feeding of quality forage crops. Such improvement in nutrients will be able to practice more immediately.

To improve the productivity of local species, however, it is most efficient, for the purpose, to promote crossbreeding with pure Holstein. This technique has been already applied to the cattle in the Project Area but at present there are only 7,000 head of hybrid cows, and more than 90% of cows in the Area is local species. This will be due to the absence of breeding stations and insufficiency in number of the veterinarians and the inseminators.

Hybrid cows are superior to local cows in body and productivity.

The artificial insemination is more effective than the natural crossing as shown below;

- to be applicable to insemination for a large number of cows and to shorten the period for improvement
- to reduce farmers' expenses in bull breeding
- to be unnecessary with transportation of cows to the centers
- To increase conception rate
- To prevent infectious diseases from reproduction (for example trichomoniasis and so on)

Among the above mentioned effects, availability of mass to insemination by using a few superior bulls is the most excellent feature of this technique, which is impossible for natural insemination. Generally, one bull can inseminate 5,000 to 10,000 heads of cows.

For the purpose of increasing animal products production and self-sufficiency in the Project Area, it is very important to produce a large amount of forages and to improve local species, for which artificial insemination is the most effective measure.

At present the artificial insemination is carried out by using frozen semen transported from Tehran but the breeding stations should be established in the Project Area taking into consideration the necessity for local species improvement. In the breeding station, the management of the bulls, semen collection, dilution, freezing and stocking will be conducted and artificial insemination services will be also carried out by trained inseminators.

The staffs required for management of the breeding station are two persons for administration, three veterinarians, five inseminators but increase in the number of veterinarians and inseminators is considered indispensable to promote animal species improvement in the future. It is desirable that about 150 veterinarians and about 100 inseminators are assigned finally in the Project Area for effective veterinary services and prevention of epidemics. Every veterinarian should be well qualified for insemination as well. As for the education of veterinarians, exertions by the Government will be desired; however, inseminators can be trained in a comparatively short period. Therefore, if this station has a function to give three to five month training for insemination it can be expected to give a considerable effect on animal husbandry.

In parallel with taking the countermeasures as mentioned above, strengthening of selection of superior bulls and cows and also low-productive cows should be culled to promote animal improvement.

(2) Countermeasures for Improvement of Forage Crops Production

The Project Area would be characterized as the paddy mono-culture area occupying about 93% of the cultivated land. In case of Amol-3, the cropping period is from the end of March to the beginning of October. Therefore, in this period, livestock is compelled to graze rice straw and wild grasses, resulting in low nutrients to the livestock. And also the productivity of wild grassland is very low and the grassland is in overgrazing conditions because of competition with sheep and goats.

Under such conditions as mentioned above, it is considered that the most important factor for livestock development is to produce forage crops in good quality, and the second crops grown in the paddy fields are the one way to meet the requirement in the paddy mono-culture area..

As for the second crops, berseem (Egyptian Clover) which has been already cropped in the Project Area is suitable for the reason as mentioned below;

- Forage crop suitable for heavy clayey soils
- Possible to reduce input of nitrogen fertilizers for paddy cropping following to berseem by nodule bacteria's nitrogen fixation
- Less labour requirement than the other upland crops
- High palatability for livestock

Rice straw which is the main feed in the Project Area contains a low level of digestible crude protein (DCP,) and single feeding of

the straw will result ill-balance in nutrients and low productivity of animal. Originally cattle is fed with roughages and produces 6 - 15 kg milk per day by single feeding of roughages.

The following table shows the nutrients production at present and projected berseem as the second crop in the paddy fields and grazing capacity estimated based on the nutrients production per hectare.

Feeds	Yield (kg/ha)	Contents (%) DCP	Contents (%) TDN	Production (kg) DCP	Production (kg) TDN
Present					
Rice Straw	4,500	1.0	37.0	45.0	1,665.0
Wild Grass on Levee	90	0.8	13.8	0.7	12.4
Paddy Stubble & Ratooning	1,350	2.1	14.5	28.4	195.8
Total				74.1	1,873.4
Project					
Rice Straw	4,500	1.0	37.0	45.0	1,665.0
Wild Grass on Levee	90	0.8	13.8	0.7	12.4
Berseem	60,000	3.4	12.4	2,040.0	7,440.0
Total				2,085.7	9,117.4

Note: DCP (Digestible Crude Protein)
TDN (Total Digestible Nutrients)

According to the estimation, present DCP and TDN production are 74.1 kg/ha and 1,873.2 kg/ha, respectively, and in case of projected berseem as second crop at the paddy fields, DCP and TDN production are 2,085.7 kg/ha and 9,117.4 kg/ha, respectively.

For example, in assuming that one hybrid cow with 450 kg of body weight consumes 1,314 kg per annum (3.6 kg/day) TDN for its maintenance, grazing capacity per ha is estimated at 1.4 heads in existing paddy land and 6.9 heads in projected one.

Existing feeds such as rice straw and wild grass contain little DCP; therefore, berseem feeds will improve nutrients supply to cows considerably.

1) Cropping Calendar

At present, a farming practice of berseem to sow in paddy field before harvesting paddy is encouraged to secure suitable growing period of berseem, but high yielding of berseem is not so expectable under such practice because of uneven spread of seed and loss of seed due to rainfall.

Therefore such cropping practice to sow berseem seed after plowing and harrowing the paddy field in this Master Plan taking into account the saving of quantity of labour as well as working period by means of farm mechanization. The target yield in the Project is estimated at 60 tons/ha, and 200 kg/ha DAP or 50 kg/ha urea and 150 kg/ha TSP should be fertilized to reach the target yield.

The present and projected labour requirements for berseem cropping and projected mechanization system is shown in Table 5.3.4.

Table 5.3.4. Labour Requirement for Berseem

- present (per ha)

(Unit : man days)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Ber-seem	graz-ing	graz-ing	graz-ing	plow-in 3.5					Seed-ing 0.6	top dressing 0.5	grazing or 1st cut	graz-ing	4.6

- with Project (per ha)

	man (man. day)	machine (tiller) (hours)
Basal Dressing	0.6	-
Plowing	0.4	3.5
Stamping	0.3	2.5
Harrowing	0.2	1.6
Seeding	0.3	2.7
Tamping	0.2	1.3
Harvesting	0.8	6.5
Top Dressing	0.6	-
Harvesting	0.8	6.5
Top Dressing	0.6	-
Harvesting	0.8	6.5
Plowing-In	1.8	14.0
Total	7.4	32.5

At present the most popular agricultural machine in the Project Area is a power tiller but in the future this type of the machine will be replaced to the four wheel tractor gradually, and berseem will be cut by mower attached to the tractor. For a transitional use, a recipro-type mower will be available for some type of the existing power tillers (refer to photographs and specifications in Table C.3.10 in Appendix C-3).

There are some problems on berseem cropping such as ill-drained paddy fields in the middle and low land and requirement of fences surrounding paddy field for preventing trespassing of stranger cattle. As for the countermeasures for these problems, it will be necessary in the future that traditional stubble grazing of animal must be changed into dry-lot feeding in each farm household gradually by administrative leadership when

berseem cropping is extended in the Project Area. Such gradual changes in animal husbandry are also related to the farm mechanization system, in which automatic-threshing type combine for paddy harvesting is planned to be introduced.

When this type of combines and even binders will be diffused in the future, rice straw will not remain standing in the paddy fields. Therefore, stubble grazing must be transformed gradually into dry-lot feeding.

2) Cropped Area for Berseem

At present, there are about 90,000 heads of cattle and about 95,000 heads of sheep and goats in the Project Area. Simply considering, grazing capacity is estimated at 2.7 heads per ha based on existing paddy fields of 68,120 ha and 185,000 heads of livestock. Considering the low productivity of wild grasses and low nutrient value of rice straw and wild grasses, it is natural that the Project Area should cause overgrazing and result in mal-nutrition of livestock. Berseem has been introduced to improve these circumstances, but actual cropped areas for berseem are only 2 to 4% of paddy cropping area. The followings show the study on required amount of berseem for existing number of cattle and sheep and goats.

	More than 3 Years		1 - 3 Years		Calves		Total
	t/head	head	t/head	head	t/head	head	tons
Local Cows	9.43	x 51,870	7.33	x 20,262	5.68	x 8,915	
	= 489,134 tons		= 148,520 tons		= 50,637 tons		688,291
Hybrid Cows	15.72	x 2,776	8.40	x 2,498	6.90	x 1,666	
	= 43,639		= 20,983		= 11,495		76,117
Pure Cows	18.86	x 810	10.49	x 1,106	8.31	x 783	
	= 15,277		= 11,602		= 6,507		33,386
Sheep & Goats			2.47 x 94,595 = 23,365				23,365
Total	548,050 tons		204,470 tons		68,639 tons		821,159 tons

Note: Amount of berseem requirement is based on the projected feed and feeding shown in Appendix C-3.

Learned from the above table, about 821,160 tons of fresh berseem will be needed to keep animals healthy. Meanwhile, the present berseem yield as second crop is estimated at about 30 tons/ha judging from the fertilizer input available and farming management in the Project Area. Therefore, the area required for berseem is calculated at 27,370 ha, corresponding to 40% of the existing paddy fields. As the existing cropping area of

berseem is only 4%, as mentioned before. Extension services for berseem by the Extension Office and Animal Husbandry Office must be strengthened to raise cropping ratio up to 40%.

Taking into consideration the marketing of surplus berseem to outside the Project Area and increase of hybrid and pure cows, the cropping intensity of berseem must be raised at least up to 50% to 60% in the future.

3) Berseem Seed Supply

The problem on berseem cropping is seed supply. At present all of seeds are imported from Italy. In assuming that the cropping intensity of berseem will reach 50% of cropping area, 2,505 ha of seed farm will be required for production of about 1,027 tons of seeds based on the expected yield of about 410 kg/ha.

It is said that Mazandaran Province is not suitable for seed production because of meteorological conditions, having rainfall at harvesting season of seeds. From the meteorological point of view, adjoining Gorgan and/or southern region such as Khuzestan are suitable for seed production, and so it will be desirable to establish seed farm in these two regions.

4) Forage Dryer

The cropping season of berseem is from the beginning of September to the end of April and berseem is finally plowed-in the paddy fields as green manures.

In the Project Area, grazing in the fenced paddy fields is more popular than soiling. For the period from the end of March to September, which is the cropping season of paddy, livestock has been fed with wild grasses and stored rice straw and a little amount of concentrates, but under these circumstances, feed and feeding have not met nutrient requirement for livestock in quantity and quality. For the cropping season of paddy, berseem must be fed as hay in place of soiling. However, unfortunately, as the cropping season of berseem is the wet season in Mazandaran, it is difficult to make hay by sun-dry and it means that suitable mechanical drying method should be applied. When the feeding method by using berseem in soiling and hay are decided, the feeding system throughout the year will be completed.

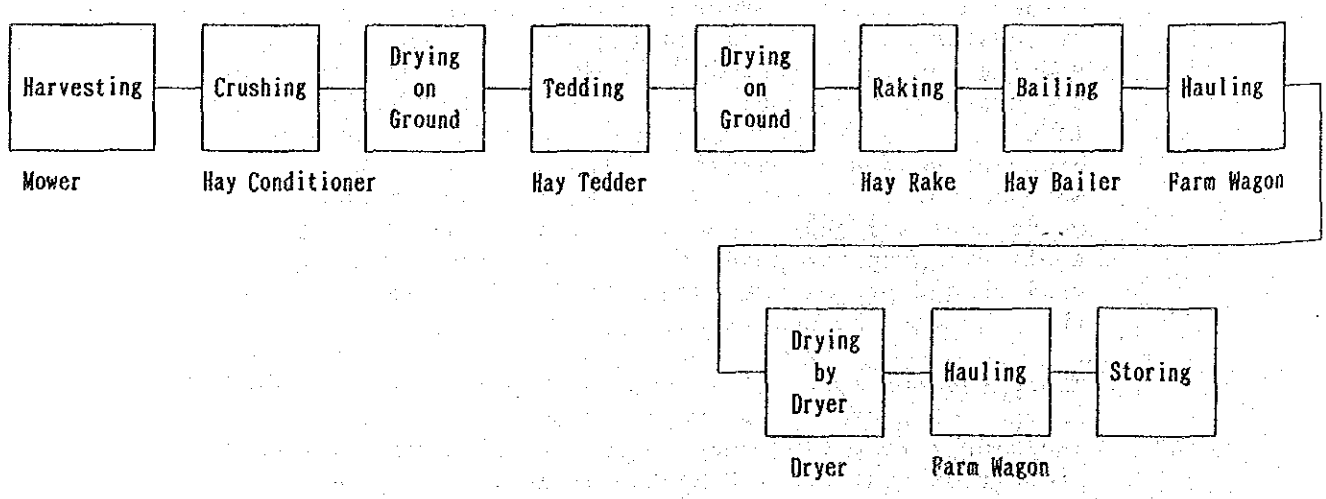
There are two types of dryers, a large-scale type for large amount of hay making and a small-scale for the individual farmer or cooperative uses. However, the production cost for 1.0 kg hay is lower in large-scale type than small-scale type as shown in Table 5.3.5.

Table 5.3.5. Study on Dryers

	Small Type			Large Type	
	MTM-100	MTM-114	GD-15A	MTM-3600	PH-24
Unit Price (rials)	1,740,000	3,000,000	170,000	3,440,000	3,400,000
Capacity of Drying Room(m³)	15.45	28.0	NA	59.8	66.6
Drying Hours (hours)	8	12~15	8~12	14~17	10~12
Fuel	Crude Petroleum	Crude Petroleum	Kerosene	Crude Petroleum	Crude Petroluem, Kerosene Light oil
Fuel Consumption (ℓ)	200 (25 ℓ/hr)	270 (20 ℓ/hr)	140 (10 ℓ/hr)	388 (25 ℓ/hr)	275 (25 ℓ/hr)
Electricity Consumption(kw)	62 (7.75kw/hr)	162 (12kw/hr)	-- --	186 (12kw/hr)	88 (8kw/hr)
Cost of Fuel (rials)	500	675	350	970	688
Cost of Electricity (rials)	496	1,296	--	1,488	704
Total Cost	996	1,971	350	2,458	1,392
Cost per kg of Hay(rials/kg)	1.1	0.9	0.7	0.5	0.3

Note : Oil; 2.5 rials/ℓ
Electricity; 8 rials/kwh
Depreciation Cost and personnel expenditure are not included.

Figure 5.3.1. Operational Method for Hay Making



Pre-drying is generally required before putting forages into dryer to decrease moisture contained in grasses up to 40 - 50%, for lowering fuel consumption and production cost. In order to make such kind of half-dried hay, berseem must be cut in the morning in a fine day and be tedded 2 or 3 times by tedder and then half-dried berseem hay with 40 - 50% moisture would be made in the afternoon in the following day. Even in the Project Area, two continuous fine days will be able to make pre-drying. Therefore, such method shall be tested in the Area from the fuel saving point of view. Drying is more efficiently in the form of bale of hay.

General Descriptions of Large-scale Dryer

Objects	:	Forage Crops, Rice Straw and others
Form of Objects	:	Compacted Bale, Loose Bale and so on
Capacity of Drying Chamber	:	2,000 kg (moisture 50%)x 4 rooms = 8,000 kg (max.)
Moisture	:	Before drying 40 - 50%, after drying 15%
		(" " 85 - 90%, " " 15%)*
Weight after Drying	:	About 4,700 kg
Drying Period	:	10 - 12 hours/time
		(19 - 20 " ")*
Fuel	:	Crude Petroleum (available for light oil and kerosene)
Fuel Consumption	:	20 - 30 lit./hour (average 25 lit./hour)
		250-300 lit/time
		(475-500 lit./time)*
Wind Blower	:	300 m^3/min. x 100 mm Aq
Electricity Consumption	:	80-96 kWh
		(152-160 kWh)*

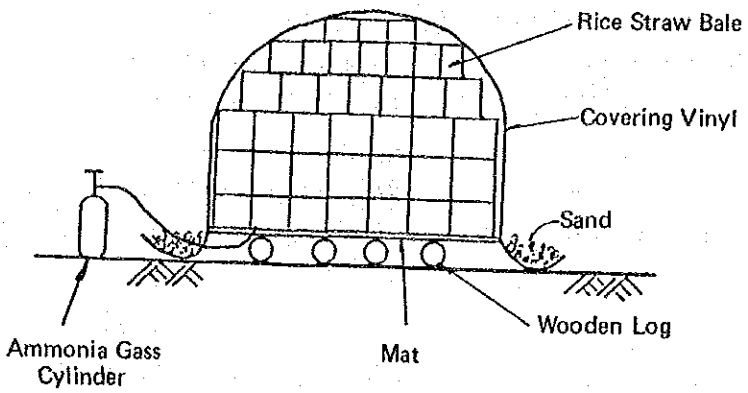
Note: Figures in ( )* show the case of unavailable of pre-drying.

5) Utilization of Agricultural By-products

There are 68,120 ha of paddy fields in the Project Area and the amount of agricultural by-products from these paddy fields are estimated at 37,440 tons of rice straw, 63,350 tons of chaffs and 15,330 tons of rice bran. The rice bran has been used as feeds for poultry and cows. The rice straw is also fed to cattle throughout the year but has defects in low digestibility and low DCP content. Chaffs are burnt after hulling and are not used for animals.

Some trials have been made to utilize those by-products as animal feeds in European countries, Japan and some other countries.

For example, there is a method to process rice straw by ammonia gas for improving its digestibility and nutrients value (refer to the following figure). Ammonia is generally considered harmless to animals and human beings, and in addition the ammonia treatment method is so easy as to be applied even by farmers.

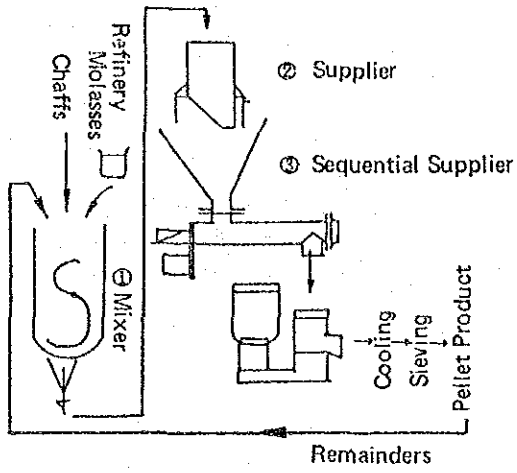


It is confirmed that the ammonia treated rice straw will raise its digestibility and nutrients values as shown below.

Treatment	Nutrient Ingredients				Digestibility					Digestible Nutrients	
	Crude Protein	Crude Fat	NFE	Crude Fiber	Dry Matter	Crude Protein	Crude Fat	NFE	Crude Fiber	DCP	TDN
Non-treatment	3.5	1.5	49.9	37.8	41.5	0	38.1	41.4	55.3	0	42.9
Moisture 25%, NH3, 1%	6.1	1.1	47.9	37.7	45.4	23.1	32.0	39.8	63.2	1.4	45.3
- do - , NH3, 2%	7.0	1.2	46.8	37.5	45.5	27.5	25.4	40.9	62.6	1.9	45.3
- do - , NH3, 3%	9.1	1.4	44.3	38.1	51.9	37.6	56.2	44.6	71.0	3.4	51.9
Moisture 14%, NH3, 3%	6.5	1.3	46.3	38.3	46.2	20.0	49.4	40.9	64.4	1.3	46.4

The nutrient value of chaffs is as low as that of the rice straw specially in digestible crude protein. However, chaffs could also be improved by adding molasses to the milled chaffs. There are some possibilities to solve the problems on feed resources if these chaffs can be used as a animal feed.

The following figure and tables show the procedures of chaffs and the results of analysis for processed chaffs.



General Ingredients of Chaff Pellet and Rice Straw

Objects	Moisture	Crude Protein	Crude Fat	NFE	Crude Fiber	Crude Ash
Pellets	12.4	2.4	0.4	37.3	32.2	15.3
Raw Chaffs	9.5	2.8	0.9	29.2	39.8	17.8
Rice Straw	12.3	4.3	1.7	37.8	28.8	15.1

Digestibility and Nutrient Values of Chaff Pellet and Rice Straw

Objects	Crude Protein	Crude Fat	NFE	Crude Fiber	Dry Matter	DCP	TDN
Pellets	11.1	63.8	51.9	39.1	88.7	0.23	33.28
Raw Chaffs	10.0	40.0	29.0	8.0	90.5	0.3	12.7
Rice Straw	26.0	40.0	47.0	61.0	87.0	1.1	38.00

Although some facilities will be necessary for processing the pellet of chaffs, the experiement on ammonia treatment of rice straw and actual feeding test with treated straw will be easily carried out even in the Project Area.

(3) Countermeasures for Improvement of Animal Health and Hygiene

There are some infectious animal diseases such as anthrax, foot and mouth disease, rinderpest, brucellosis, new castle, and other diseases caused by parasites infestation. Prevention and diagnosis services for animal diseases have been done by the local Veterinary Office but a preventive organization has not been completely provided yet in Amol and Babol Shahrestan due to insufficiency of veterinarians in number.

The mortality rate of animals due to above-mentioned diseases seems to be very high, but there is no statistics available to clarify the matter. Generally, farmers' interest to animal health and hygiene is not so high. For example, the ventilation and lighting the cow sheds are not considered sufficiently, therefore, it is often resulted to aggravate occurrence of animal diseases.

To overcome these unfavorable circumstances, the countermeasures such as an increase of the veterinarians, burning the dead bodies infected by diseases, preventive injections, prescriptions, spraying pesticides, and in addition, campaigns for farmers' education on public conscious of animal hygiene, will be important factors.

There are the clinics in the Agricultural Office in Amol city and Babol city, which are outside the Project Area. As for the veterinarians, two for the former and one for the latter are allocated, and several technicians assist them. But actually assigned staffs are insufficient in number, and therefore, assignment of about 150 veterinarians and amplification of the existing clinic center including increase of cars and motorcyles will be also necessary for the effective veterinary services. However, a certain period will be needed for education and training for necessary number of veterinarians, and so supporting activities by the government will be required.

However, it is considered possible even at present to awaken hygienic mind of the farmers through distribution of pamphlets, etc., to put on the farmers an obligation to report the outbreaks of animal diseases, and to patrol around the villages in rotation system. Those activities will be also very effective for the personnel concerned to grasp the present situation of animal health and hygiene in the rural area.

The animal clinics will function under the control of the Veterinary Office. The components of the services are as follows;

- Services for extension and arousing hygienic thoughts to the farmers
- Services for prevention of infectious animal diseases

- Services for expelling reproductive disturbances
- Service for artificial insemination
- Experiments and inspection on animal health and hygiene
- Medical and diagnostic services for animal diseases suffering from parasites
- Other services for heightening animal hygiene

It is considered that cattle would be kept in the sheds in the future with extension of berseem cropping. In that case, residual rice straw and other forages should be swept daily to keep hygienic environment in the cattle sheds. These residue should be utilized as organic manure in paddy fields and uplands in and outside the Project Area.

(4) Countermeasures for Improvement of Extension Services on Animal Husbandry

Extension services on animal husbandry have been made by the rural service center in Babol but there is no special organization for the purpose in Amol, and as a result extension services in Amol are stagnant. Main activities of the center is to distribute forage crop seeds and to conduct epidemic prevention works and preventive injections, etc.

In the future, extension activities should be concentrated on berseem cropping because forage production is deemed as the urgent necessity, and also some period will be needed to establish a complete organization for epidemic prevention.

According to the estimation based on the distributed amount of berseem seeds in the Project Area, the present cropped area is only 2% to 4% of paddy fields and those areas mainly extend in the high land areas as confirmed by the livestock farming survey. The farmers keep two cows on the average but berseem cropping is not extended in the Project Area inspite of indispensability of good forages for the sound animal husbandry. It is due to poor drainage conditions of the paddy fields, lack of cutting machines, necessity for fencing paddy fields and insufficiency in extension services for berseem production. The Extension Office has prepared the pamphlets explaining berseem cropping as second crop; however, contents should be indicated more concretely about cropping practice. Therefore, the revised pamphlets with more concrete explanation should be distributed to the farmers as soon as possible. The extension activities by using small demonstration farm should be carried out for berseem cropping in the selected paddy fields in each villages by the Rural Service Center and Agricultural Office under leadership of the Extension Office. Berseem cropping itself is not so difficult, and so those small demonstration farms are considered

very effective to enlighten farmers and in the high land areas with good drainage condition, this would be practised more easily.

(5) Countermeasures for Improvement of Animal Products Processing

According to estimation, annually about 40,000 tons milk is produced in the Project Area but very small amounts are marketed because of insufficiency of milk collecting system and absence of processing factory. Dairy products are indispensable foods for Iranian people and this is a reason why the farmers keep cows even in a small scale to make yoghurt, butter and milk for family use.

In Sari city, about 60 km east of Amol city, there is a milk factory with a capacity of 10 tons per day. As milk production in the Project Area is expected to be increased and the dairy products will be marketed not only in the Project Area but also in its peripheral areas in the future, the milk processing factory plan in the Project Area is to be provided and implemented.

There exists a slaughterhouse in the Project Area but the capacity is not sufficient and not equipped with the processing facilities of bone and blood which are usable as mixtures for animal feeds, and also the waste disposal facilities; therefore, modernized slaughterhouse should be established to meet the appropriate number of livestock in the Project Area.

In addition, it is considered valuable to study the construction a leather factory for processing raw hides and skins which have been transported to Tehran so far.

1) Milk Processing Factory

The amount of milk to be processed after deducting milk for suckling calves is estimated at 220 tons/day to 314 tons/day in case of 50% cropping intensity of berseem. Therefore, a milk processing plan is to be studied in the further stage of project based on such potential production.

The lack of milk collecting system which is the problem in marketing, is to be solved by means of establishment of milk collecting station in the Project Area. The milk collecting station will be equipped with the bulk coolers, measures and some inspection apparatus in assuming that milk is collected by tank lorries. The 63 stations should be constructed in the Project Area so as for one station to cover eight villages.

In the factory, drinking milk, yoghurt, dough, butter etc. will be processed and about 250 staffs will be necessary for management and processing.

2) Slaughterhouse

As the Project Area has been facing difficulty in overgrazing at present, livestock slaughtering has been encouraged, particularly in summer a large number of livestock have been slaughtered to cope with insufficiency of forage resources. According to the number of livestock feedable in the future, slaughtering capacity is estimated at 150 heads of cattle per day and 200 heads of sheep/goats per day. About 200 staffs will be necessary for operating and management.

3) Leather Factory

The treatment procedure in the factory is planned to make pickled skins and to package them for transportation to the tanning factory in Tehran. About 20 persons will be required for operation. The following show the procedures.

Washing - Tapping - Deharing (cattle hide) - Straining - Deliming - Washing - Pickled Skins - Packaging

5.3.6. Measures for Existing Cultivable Lands

There still remain about 3,690 ha of forest in the Project Area, about 320 ha of which extend east of the Amol-Mahmud Abad Road (Tashibandan District) and the remaining 3,370 ha extend along the Alesh river. The forest consists of those various woods like elm, maple, acacia, etc. Most of the forest is covered with thickly growing throns, boxwoods and other weeds on its land surface, although some marsh land is observed during the rainy season in the downstream area of the Alesh river downstream area. And parts of the forest have been cleared for cultivation by the local farmers.

On the other hand, there are many reservoirs (abbandans) with a water surface of about 3,830 ha in total in the Project Area, which are used as supplemental water sources by storing the drainage water from the upstream area.

As mentioned in the para. 5.3.2.(1), it is desirable that the above-mentioned existing cultivable land will be kept intact for a high levelled use of them in the future without implementing the land consolidation nor decreasing its acreage by any means. The improvement plan of the land in this line is proposed hereinafter.

(1) Existing Forest Land

Existence of forest itself can contribute to the conservation of living environment for local people. The forest in the Project Area, however, is quite low in its productivity under poor maintenance services, and there are some parts of the forest

occupied illegally by the local farmers. In other respect, being respect, being quite small in the total acreage, the forest in the Project Area can not be involved in regional development projects as forestry development scheme.

Under the circumstances, the following surveys could be proposed as the premise for formulating an improvement plan of the forest.

1) A cadastral survey shall be conducted for the existing forest so as to estimate the total national forest and ensure the boundaries, and the countermeasures to be taken against illegal occupation shall be determined against illegal occupation, when found.

2) A vegetation survey shall be carried out for the existing forest in the Project Area to clarify the growth density of productive trees and various factors to hinder the trees from growing.

3) Based on the above survey results, a study shall be conducted on the effective use of the existing forest. Being small in acreage, the forest in the Tashibandan district will be able to remain as a natural park, if it is provided with roads and drains therearound. As for the existing forest along the Alesh river, it is considered possible that it will be turned to a well maintained forest for timber production and grazing land as well by way of intermittant fellings and drainage improvement for increase in its productivity since it has a considerably large acreage inclusive of the forest in the Nur District. Consequently, the aforesaid items 1) and 2) shall be realized for both Districts of Amol and Nur.

(2) Existing Reservoir

Many of the existing reservoirs are small in their storage capacity, having more reservoir area in total than the irrigation area to be covered. This is because the water is comparatively shallow and there are thick bushes around the reservoir shore which decrease the storage capacity. As mentioned in section 5.2, most of the reservoirs shall be used as supplemental irrigation water sources and retarding basins of drainage water. Therefore, such countermeasures shall be taken preferentially to meet the above purpose as adequate dredging, embankment, construction of necessary facilities and proper maintenance works.

The improved reservoirs for irrigation/drainage will be able to be utilized as fish culture and duck husbandry which are frequently observed in the Southeast Asian countries. In the Project Area, many farmers have been raising many aquatic poultry like ducks. Under the situation, an intensive raising of such poultry can be

taken into consideration. In such case, the feed supply problem should be solved first of all in the same way as chicken husbandry.

The fish culture can be realized more easily than the duck raising. The following problems should be surveyed firstly for successful fish culture.

1) Survey on Water Quality - water temperature, transparency by season and by depth at surface and at bottom, undissolved oxygen (4 mg/lit. at minimum required for fish habitation), acidic carbon, pH, alkalinity (more than 40 mg/lit. preferable), total hardness (20 mg/lit. as minimum requirement), phosphate (0.05 mg/lit. as minimum requirement), NH_3-N (Ammonia - more than 1.5 mg/lit. harmful to fish), suspended solids, chlorophile, etc.

2) Survey on Aquatic Micro organisms - kinds of planktons of flora and fauna, bottom organisms, surface organisms, organic materials, etc. The surveys of these items are necessary to grasp the actual state of feed supply capability of water, and the seasonal fluctuation of them should be surveyed.

3) Survey of Aquatic Flora - Aquatic flora including algae at shores and surface of the reservoirs should be surveyed ecologically.

4) Survey on Fish and Other Aquatic Fauna - Existence of fauna like pikes and carps is recognized, and the survey should be made on kinds, population, habitation conditions of those and other fauna.

According to the survey results, the further study shall be made on selection of suitable species for fish culture, economical number of fingerling to be stocked, possibility of natural egg laying, potential productivity, etc. Since the reservoirs give the first priority to control the irrigation and drainage water, the water level and water temperature will have large fluctuation, and consequently, the fish culture in the reservoir shall be carried out with appropriate selection of fish suited to cultivation and adequate population to be cultivated. Under the condition, it may be necessary to study the maintaining the appropriate water depth for successful fish culture. In principle, the natural feeding is desirable, but pen or cage culture may be required according to the result of the above survey on suitable fish selection. In such case, the study on providing pallet manufacturing plant to meet the requirement will also be necessary. For fingerling propagation plant, the existing Semes Kande fish station will be utilized in extending its scale.

5.3.7. Measures for Reinforcing Agricultural Research & Experiment

Aiming at the improvement of paddy varieties for higher yield, the agricultural research and experiment in the Project Area centering around Amol Rice Research Station have been specialized in paddy cultivation. For the other crops, experimental results in other regions have been introduced to the Project Area. However, no natural conditions of the Project Area are carefully taken into consideration in doing so. Even in the Project Area climatic and hydrological characteristics of different sub-areas such as the high, middle, and low land are not taken into account. Furthermore, no soil survey has been sufficiently conducted. For instance, despite that the recommended varieties of paddy rice such as Amol-3 show fluctuating yields per unit area, no study on climatic and soil factors has been carried out for cultivation of such varieties. In the other words, the agricultural research and experiment are conducted limitedly in the research center, without paying attentions to the adaptability of experimental results to different sub-areas. Replying to farmers only when they inquired, the research and experiment seem to maintain passive stance to this field of activities, resulting in the fact that farmers do not show deep interest in the strengthening of agricultural research and experiment as mentioned in the para. 2.5.4.(3).

To attain a high agricultural productivity in the Project Area, various basic researches would be necessary as mentioned in Section 4.4. Simultaneously the experiment for on-the-field application of advanced technology cannot be ignored.

The Ministry of Agriculture is planning to establish an Agricultural and Natural Resources Research Center in the suburbs of Sari so as to reinforce research and experimental activities in Mazandaran. The basic research would be undertaken at the said center in future, accordingly. It is noted that the natural conditions of farmland delicately affect the crop yield in most cases. As the yield per unit area has already reached a certain level, it will be one of the most important factors in achieving a higher yield per unit area than present to extend the research and experimental results to farmers' level in consideration of the characteristics of each sub-area.

To meet those requirements, the agricultural research and experiment activities shall not be conducted limitedly in the research center and its branches only. The activities shall cover the improvement of farm practices including the introduction of new technology in cooperation with the extension services as explained in the following paragraph and the CAPIC Plan which is explained in the para. 5.5.10 below.

From the above-mentioned points of view, it is recommended to conduct researches, experiments, verification of new technologies, and extension services and related activities, which are necessary

for cultivation of paddy and second crops, aiming at the improvement of the existing conditions, improvements premising the land consolidation, and further improvement in the future. Table 5.3.6. shows itemized works for this improvement and the organizations in charge of such improvement.

(1) Paddy Rice Cropping

1) To provide each sub-area of the Project Area with appropriate number of observation points of cropping conditions and yield so as to study the necessary improvement measures, and to prepare statistic data necessary for yield forecasting, etc.

2) To increase the number of light traps, to get hold of the actual conditions of insects outbreak, and to provide a forecasting system of insects damage.

3) To strengthen the study on the characteristics of traditional and new varieties. Moreover, to study the optimum varieties for farm mechanization, and to study a possible way to introduce bio-technology for breeding new varieties in the future.

4) To plan a consistent system of research, verification, and extension to strengthen such fields of activities as closely related to cultivation like the raising of seedlings, management practices, water management, prevention of diseases and insect damages, and planting. Furthermore, to study and verify new technologies premising farm mechanization.

5) To verify land consolidation technologies for farm mechanization, and study farm machinery including their economic aspects.

6) To study post-harvesting technologies for the process of drying - storing - milling.

(2) Second Cropping

1) Experiments necessary for establishing a technical system for cultivation of berseem including the plowing before sowing, land levelling, seed quantity to be sown, sowing methods, fertilizer application, leaping time, yield and so forth so as to study the economic aspect of each cultivation method.

2) The same experiments mentioned above for berseem shall be conducted for winter vegetables. Moreover, the experimental cultivation of new vegetable varieties, which are considered productive in the Project Area in consideration of its climatic conditions and so forth, shall be conducted.

Table 5.3.6. Verification, Research/Experiment, and Extension/Survey Items for Paddy Rice and Second Crops

Items	Improvements of Present Cultivation				Improvements with Land Improvement				Future Subjects		
	Extension & Survey / Research/ Experiment				Extension & Survey / Research/ Experiment				Research/Experiment		
	ARTSC	ANRRC	CAPIC	Others	ARTSC	ANRRC	CAPIC	Others	ANRRC	CAPIC	Others
General											
· Yield forecasting	○	○			○	○	◎				
· Agrometeorology (crop growth/yield - climate)	○	○			○	○	○◎				
· Optimum paddy cropping seasons(early planting and late planting)						○	○◎				
· Cultivation with direct sowing										○◎	
· Yield survey from a viewpoint of yield components	○	○	◎		○	○	◎				
Varieties											
· Replenishment of a study on characteristic of varieties (plant type, fertilizer tolerability, cold resistance, shedding habit, ripening, etc.)		○									
· Selection and raising of suitable varieties for farm mechanization						○	◎				
· Introduction of bio-technology(for breeding new improved varieties)									○		○
Seedlings											
· Methods for seed selection	△	○	◎								
· Nursery bed types	△	○	◎								
· Optimum nursery period(nursery period - growth/yield)	△	○	◎								
· Raising methods of young seedlings					△	○	○◎				
Farm Management Practices											
· Cultivation guidance by varieties	△	○	◎								
· Plowing times/timing - growth/yield	△	○	◎								
· Fertilizer response by kinds of fertilizers (including the relationship with soils)	△	○	◎	○							
· Influence of flowing irrigation on fertilizer response		○	◎			○	◎				
· Optimum fertilizer application by varieties	△	○	◎								
· Top dressing response/methods	△	○	◎								
· Optimum application method by kinds of herbicides	△	○	◎			○	◎				
Water Management											
· Irrigation method - growth/yield (flowing irrigation, intermittent irrigation, ponding, mid-sumaer drainage)	△		○◎		△		○◎				
· Water requirement		○	○◎			○	○◎				
· Water depth/percolation - growth/yield			○◎				○◎				
· Water temperature - growth/yield			○◎				○◎				
Disease and Pest Control											
· Forcasting method of diseases and pest	△○	○	◎								
· Optimum timing and application of pesticides	△	○	◎								
· Seed disinfection - outbreak rate of diseases and pests	△	○	◎								
Farm Mechanization											
· Walkability of agri-machinery					△	○	○◎				
· Transplanting by transplanters					△	○	○◎				
· Harvesting by combines					△	○	○◎				
· Economic verification of optimum mechanization systems for the Project Area					△		○◎				
Transplanting Method											
· Random planting/regular planting - growth/yield	△	○	◎		△		○◎				
· Planting density - growth/yield (including comparative study on various planting methods)	△	○	◎		△		○◎				
Terminal Land Improvement Technology											
· Comparative study on consolidation levels of land (A, B and C types of land consolidation)					△		○◎				
· Construction engineering and methods					△		○◎				
· Optimum plot size (optimization of lengths of short side and long side by land consolidation types)					△		○◎				
· Optimum distance of plot-to-plot irrigation (Experiment on B and C types of land consolidation)					△		○◎				
· Optimum provision of open drainage(distance, depth, structures, soil terture)					△		○◎				
· Optimum provision of tile drainage(distance, depth, structures, soil texture, materials)					△		○◎				
· Optimum length of terminal ditches (from the view points of operation and maintenance)					△		○◎				
· Accuracy in land leveling					△		○◎				
· Surface soil handling					△		○◎				
Post-Harvesting Technology											
· Drying-storage-milling process	△		○◎		△		○◎				
Second Crops											
· Establishment of techniques on berseem cultivation					△	○	◎				
· Establishment of techniques on various winter crops					△	○	◎				
· Experiments for introducing oil seed crops					△	○	◎				
· Experimental cropping in a green house					△	○	◎				
· Processing technology of secondary canals							◎	○			
Environmental Assessment											
· Influence by pesticides and herbicides									○		○
· Eutrophication of inland and the Caspian Sea water									○		○

Note) ANRRC : (Agriculture and Natural Resources Research Center)
△ : Extension ○ : Survey, Research/Experiment ◎ : Verification

3) Experimental cultivation of oil crops like rapeseed, etc., and industrial crops shall be taken into consideration so as to introduce them to the Project Area.

4) Experimental cultivation of vegetables in simple green houses with vinyl sheet cover shall be conducted in order to utilize effectively rice hulls as the source of heat because rice hulls are presently left uselessly in the Project Area.

5) Experiments of processing technology of second crops including drying of berseem and processing of oil crops shall be carried out.

In addition, a comprehensive study from a long-range view on the environmental pollution caused by agricultural chemicals and herbicides, and the eutrophication of inland and the Caspian Sea water will be necessary in near future.

5.3.8. Measures for Reinforcing Agricultural Extension Services

The effectiveness of extension services for increasing the agricultural productivity is doubtless as looking back the actual results at the Project Area. As explained in the para. 1.4.2.(1), the increase of yield/ha of paddy in the Project Area is appraised as a result obtained from the good interaction between the Amol Rice Research Station and the extension services. Furthermore, it is considered that the extension system has been well arranged as mentioned in the above Section 3.3. But, the agricultural extension services can not be satisfied with such good results in the past and/or the well arranged system. Continuous effort of improvement and reinforcement of activities are requested. From such point of view, the problems as mentioned in the para. 4.4.9.(5) are emphasized.

At the promotion of development in the Project Area, the successful implementation will greatly depend on the extension services. The subjects of extension services will also be requested to extend toward the proper enlightenment and guidance of improvement of the farmer's institution related to the development without standing on the limited activities for extending the improved farming practice as present. Accordingly, the following manner of reinforcing measures are suggested.

(1) Reinforcement of ARTSC

The ARTSC has not yet been established in Amol Shahrestan therefore the establishment is to be urged, but there is still much room of improvement and reinforcement for already established ARTSC in Babol Shahrestan as well. Especially, the extension service activities of the ARTSC request the following improvement, and such points of improvement are to be taken into account at the ARTSC to be established in Amol Shahrestan.

1) Establishment of duty site residing system of extension crew
2) Application of proper area of duty
3) Encouragement of re-training system of extension crew
4) Clarification of subject and purpose of extension services

The extension services can not be successfully without keeping permanent and close contact with the farmers. Therefore, the extension crew is to reside in his duty site, and the duty area is to be limited within such extent that the extension crew can patrol twice a week as minimum. Furthermore, the retraining of extension crew shall be encouraged to respond to the ever changing farming practice. The subject and/or purpose of extension services are also to be confirmed and clarified by mean of periodical meetings of extension crew in the Shahrestan level to endeavor the qualitative level-up of extension crew through the exchange of view and/or reporting of activities of each extension crew at the periodical meetings.

(2) Establishment of Model Farm

The item of "assistance to establishment of model farm" in the article 33 of the law for establishing ARTSC is very important. Especially in the Project Area where the introduction of new farming practice and the improvement of farm management system are highly requested in the progress of development, the model farm shall be established at least one to each Rural Service Center to verify the adaptability of new practice and system including the cooperative farming works on the field, and such model farm shall be positioned as a core of extension services.

(3) Cooperation with Rural Cooperative

The rural cooperative and the extension services are separated under the present system, but the cooperation between the extension services and rural cooperatives is considered to be reinforced because there is not any other farmer's institution than the rural cooperatives in respect with the agriculture production, and the introduction of new farmer's institution is not easily recommendable. Namely, the establishment of system which makes possible to respond to the different problems in the rural area is required under the close interaction of the Rural Service Center and Rural Cooperatives.

Other than the above , the relation with the agricultural research and experimental bodies shall not be overlooked. Presently, the relation between research institute and farmer is rather one sided, but the offer of research subjects from the field will enable to influence considerable effects to the result of development. For instance, the existence of farmers who are obtaining higher yield/ha of paddy than the result in the research station has been reported in the Project Area, but any proper study on the reason for such higher yield has almost not been undertaken. It is considered that new approach will be possible in the improvement of farming practice if such fact is confirmed and the reason is studied carefully.

5.4. Rural Life Environment Improvement/Reinforcement Scheme

The development of the Project Area will be proceeded by mean of increase of productivity planning the introduction of advanced technology based on the implementation of Land Improvement Works, but there will be foreseen various socio-economical changes and also be requested such changes. The improvement and reinforcement of the rural life environment are to be studied to respond to those expected socio-economical changes. Therefore, the character of expected changes are to be clarified for the first instance, then the needs of rural inhabitants who are the beneficiary of the Project shall be confirmed periodically, and the further development is to be studied thereon.

The expected changes prior to the commencement of the project will be as below.

(1) Occurrence of surplus labor due to introduction of mechanization of paddy cultivating practice.

(2) Increase of requirement of cooperative working system responding to introduction of new technology including mechanization.

(3) Increase of demand of skillfulness in farm management or requirement of qualitative level up of agricultural labor.

(4) Increase of requirement of planning in farm management for securing the capital for development and/or improvement of agricultural basis and for refunding the invested capital.

5.4.1. Purpose of Scheme

The present needs of project beneficiary reported in the Village Survey - 1364 are summarized as below:

Firstly, the shortage and price increase of agri-machinery and their spare parts are complaint of the beneficiary related to the agricultural tools and materials. This situation is considered as un-avoidable under the special situation at the present, but there will still be some room for improvement. Timely supply of fertilizer and chemical and the security of fuel are following to the agri-machinery problem.

As institutional problem, the stabilization of price of rice is the largest interest, and the demand of agricultural financing is following thereafter.

Related to the social infrastructures, the highest priority in the beneficiary's demand is hygienic water supply, and they are also interesting on the improvement of public bath, roads, medical facilities, telephone, educational facilities, mosque, etc.

Furthermore, the reinforcement of rural cooperative activities and the problem of employment opportunity especially for the younger generation are also the interest of rural inhabitants in Babol area.

Besides, the demand on road is including both of village road and farm road, and considerable number of villages complain of the necessity of improvement of farm road. Moreover, relating to the aboves, the demand on the improvement of agricultural basis such as water shortage, rationalization of water distribution, poor drainage, etc. are also reported in the Village Survey - 1364, but those problems are studied in the Section of Land Improvement Scheme.

Taking the aforementioned demands and expected changes into consideration, the targets of Rural Life Environment Scheme are tentatively set forth as below:

(1) Improvement of Public Sanitary and Health Facilities such as domestic water supply, public bath, medical facilities, etc. As for water supply and public bath, whole villages will be subject to the scheme except for those of less than 10 households size, and the target value of medical facilities may be one physician per 2,000 inhabitants which was the average of urban area in 1355 Census.

(2) As for educational facilities, the average schooling rate per the schooling population (6 - 13 years old for Primary School, 10 - 15 for Secondary School and 13 - 20 for High School) at the urban area of the country in 1355 Census may be applicable. Namely, the target schooling rate will be 84% for Primary School, 66% for Secondary School and 22% for High School, and required facilities for such number of student are to be provided.

(3) As for telephone, to install one public telephone for each village of bigger than 51 households.

(4) Assuming the total length of village road within the Project Area as 1,800 km, about 700 km of which is to be improved as passable road of ordinary truck, and twice in a year, repairing is to be planned as minimum requirement of maintenance of road providing necessary machinery and man-power for such purposes.

(5) As for supply of agricultural tools and materials and maintenance of agri-machinery, the existing system is to be reviewed, including the cooperative farming work, taking the use of rural cooperative into account. Accordingly, the rural cooperative is to be re-arranged for tightening the relation with the regional society.

(6) In the establishment of new rice mills and other rural industries, the priority should be given to rural cooperative operating ones. Furthermore, the rural cooperative is to be effectively used for the governmental procurement of rice and/or paddy.

(7) The aforementioned targets are to be achieved by 1375.

5.4.2. Potential Opportunity of Employment

The most important problem of this scheme is absorption of surplus labor which will appear due to rationalization of farm management. If there is not any possibility to absorb the surplus labor, the propriety of rationalization is also to be reconsidered. Therefore, the actual conditions of expected surplus labor are to be studied, and the following assumptions may be applicable for the study:

(1) Assuming that the high rate of population growth is a temporary trend due to change of social structure by the Revolution, the rate of population growth in 1365 - 75 is set forth as 3.0% which is nearly to the rate in 1345 - 55 period, but the rate of 3.7% is applied for 1355 - 1364.

(2) The age group structure of the population of Amol Shahrestan in 1355 is tentatively applied as that of target year.

(3) The completed area of the land consolidation works by 1375 is assumed as 16,146 ha (ref. para. 5.5.7), where the small type mechanization system will be introduced. For the remaining area, same mechanization system is introduced at the high land area where the drainage condition is acceptable for mechanization, but the working efficiency is decreased in 32 - 50%.

(4) Number of cattle in 1375 is estimated at 74,000 heads (ref. para. 5.5.8), and the required labor is one per 15 heads of cattle which consist of milk cow and fattening cattle.

(5) The cultivating area of vegetable as second crop is assumed as 2,030 ha, and the labor requirement is estimated with those of lettuce (required labor: 2,090 hrs/ha) and radish (required labor: 1,610 hrs/ha) setting forth the cropping ratio as 70:30.

(6) The cropping area of berseem is assumed as 27,370 ha and the labor requirement is estimated at 448 hrs/ha.

(7) It is assumed that present upland crop and orchard (3,750 ha and 2,010 ha) are to be maintained as it is, and 2 cropping system is applied for upland crop cultivating tomato, cucumber, eggplant, melons, beans, etc. as summer crop and lettuce, radish, etc. as winter crop. For management of orchard, the required works are to be carried out at the vacant time of other farming works.

The assumed labor requirement in 1375 which is estimated with the above precondition is shown as below:

Table 5.4.1. Estimated Labor Requirement (1375)

	FAR	ORD	KHO	TIR	MOR	SHA	MEH	ABA	AZA	DEY	BAH	ESF
Total Population of Rural Area	415,000											
Total Household at Rural Area	83,000											
Economical Active Population (15 - 65 years)	197,000 (Excluding student)											
Paddy Culture (1,000 men)	37.6	30.3	78.8	42.4	33.4	34.8	55.8	26.9	-	-	19.6	24.4
Up Land Crop/Second Crop	18.9	9.3	18.9	29.3	17.5	28.2	17.1	17.7	9.2	4.1	26.7	11.3
Live Stock Farming	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Total	61.4	44.5	102.6	76.6	55.8	67.9	77.8	49.5	14.1	9.0	51.2	40.6
Teacher for Primary School	105,000 ÷ 40 ≒ 2,600											
Teacher for Secondary School	45,000 ÷ 35 ≒ 1,300											
Teacher for High School	16,000 ÷ 25 ≒ 600											
Total	4,500											
Water Supply, Public Bath	457 village x 4 mon ≒ 1,800											
Medical Staff	415,000 ÷ 2,000 ≒ 200											
Nurse, etc.	200 x 1.5 ≒ 300											
Telephone & Post	261 village x 2 mon ≒ 500											
Village Road Maintenance	1,800km x 2.5 ÷ 50km ≒ 100 (Excluding temporary worker)											
O & M of Irrigation Facilities	68,460ha ÷ 110ha ≒ 600 (Excluding temporary worker)											
Total	3,500											
Staff of Cooperative	68,460ha ÷ 2,000ha x 6 men ≒ 200											
Repair of Agri-machine	68,460ha ÷ 500 x 2 ≒ 300											
Bakery	83,000 house ÷ 200 house ≒ 400											
Miscellaneous shop	83,000 house ÷ 500 house ≒ 200											
Total	1,100											

In the above table, the non-agricultural employment is 9,100. In case of agriculture, monthly fluctuation will still remain, but such fluctuation will be solved by mean of extension of working hour and/or use of family labor, therefore the appropriate number of farmers is set forth as 41,000 households which is almostly the same as the present number of landowner farmer. If each household supplies one labor, about 50,000 employment opportunities will be secured, but, even on one labor per a household basis, creation of employment opportunity for remaining 33,000 households will be required. Therefore, expansion of employment opportunity at the rural industries such as rice mill, service sector such as transportation, public service sector, etc. will be required.

On the other hand, the above agricultural labor requirement is estimated with small type mechanization, but the farm mechanization is expected to move toward the application of medium type or, even to large type, and, consequently, the appropriate number of farmers will further decrease. Therefore, a fundamental review of the structure of regional economy will be required in the future.

5.4.3. Arrangement and Improvement of Social Infrastructural Facilities

The social infrastructural facilities are roughly classified in the following 3 categories;

(1) As to educational and medical facilities, a part of cost for building and other facilities may be allocated to the beneficiary's expense, but the service shall be provided by the public sector.

(2) As to electricity, telecommunication, water supply facilities, etc., the facilities shall be provided by the public sector, but part of amortization and O & M costs may be refundable by mean of levying the fee, or, as road, both a construction and O & M are to be carried out by the public sector.

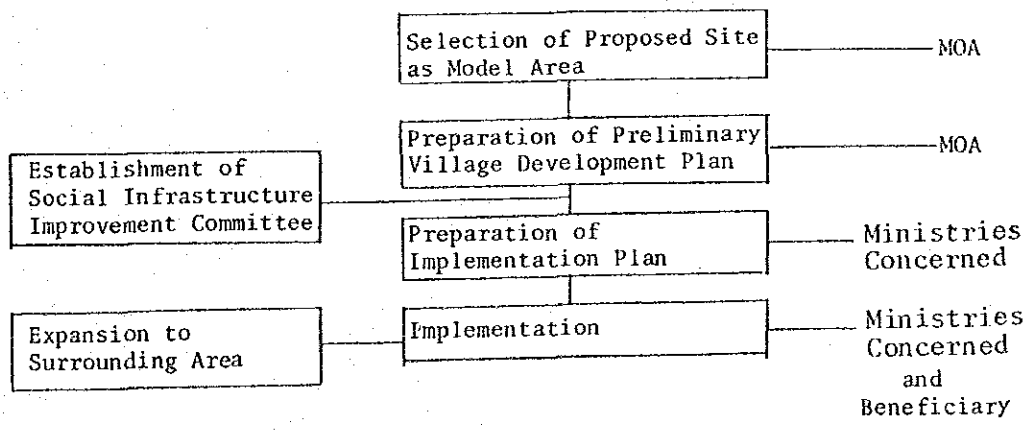
(3) As to public bath, mosque, community hall, sport ground, etc., the beneficiary themselves can provide and operate the facilities. The supply of governmental subsidy will urge the implementation.

However, the participation of beneficiary in the construction of those community facilities is not active at present, and the rural inhabitants are showing keen expectation to the governmental action thereto. Such trend is caused due to lack of self-governing function in the rural area and most of inhabitants are not interested in the improvement of their living environment.

The re-arrangement of village of a living community toward the self-governing community is not only required for the improvement of social infrastructure, but also be necessarily for improving the productive basis, and the successful re-arrangement will influence considerably in the development of Project Area.

From such a point of view, the improvement of social infrastructure is to be proceeded under the close cooperation with the farmers institution, therefore, it is suggested to establish some social infrastructure improvement committees which consist of representatives of both beneficiary and public organizations concerned selecting appropriate number of villages as Model Area.

Taking the above into account, the improvement of social infrastructures is to be proceeded as below:



As to the preparation of preliminary village development plan, the characteristics of Paddy-Livestock Combined Agriculture shall be taken into consideration together with the social condition of the Project Area.

5.4.4. Promotion of Rural Industries

The promotion of rural industries is an un-negligible factor for the development of Project Area, but the following 2 preconditions are to be taken into consideration as well as the economic feasibility of expected rural industries;

(1) To meet the demand in the Project Area
(2) Availability of material in the Project Area

From the viewpoint of economic feasibility, the scale merit and marketability shall be studied carefully. As for the demand in the Project Area, repair of agri-machinery and partially manufacturing of agricultural tools will be the main subject, and preparation of forage will follow thereto. Furthermore, as to processing industries of available materials in the Project Area, the rice milling will be listed in the first, then the processing of livestock products and vegetable, etc. will be possible beside of extraction of rice bran oil and manufacturing of soap and others using the by-products of bran oil.

The most important problems in the planning of rural industries will be constant supply of material and marketability of the product. Consequently, in case of private enterprise, the profitability of operation of rural industries is often decreased due to difficulty of material supply because self supply of material is hardly possible. Therefore, the participation of producer of materials in the operation of rural industries will be recommended in principle, and the operation by rural cooperative is more favorable from such point of view. For this purpose, the preparation of rural industrial development plan with the cooperation of Ministries of Industries and Agriculture and coordination related to the implementation program are required.

5.5. Project Formulation and Implementation Program

5.5.1. Logical Framework of Development Project

From the 3 schemes explained in the above Sections 5.2, 5.3 and 5.4, the subjects to be taken into account for the development of Project Area are summarized as below;

Scheme	Subject Matters Required
Land Improvement Works	(1) Preparation of basic data related to topography and cadaster.
	(2) Preparation of basic data related to climate and hydrology.
	(3) Establishment of measures for inundation control at low and middle land areas.
	(4) Experimental studies to verify the efficiency of irrigation and drainage, and improvement of relative facilities based on the results.
	(5) Experimental studies of working efficiency of agri-machinery by soil character and shape of farm land, and implementation of improvement plan based on the results.
	(6) Preparation of planning & design criteria, and implementation of land improvement works based on the criteria.
Agriculture Productivity Promotion	(7) Establishment of insect control system to resolve the production decrease of paddy due to pest/ insect damages.
	(8) Reinforcement of research activities on the seed improvement and applicable advanced farming practice for increase of yield/ha.
	(9) Soil survey and reinforcement of fertilizer test for defining suitable quantity of supply by kind of fertilizer.
	(10) Establishment of suitable mechanization system to resolve seasonal fluctuation of labor requirement.
	(11) Reinforcement of research activities for creation of suitable variety of paddy for mechanized farming system.

(12) Establishment of measures to lower the post harvest loss and wastage.

(13) Decrease of dependency on paddy by mean of increase of cropping intensity and establishing suitable cropping pattern for such purpose.

(14) Selection of suitable kind of second crops related to the above mentioned cropping pattern and reinforcement of research and experimental activities on the farming practice of selected kind of second crops.

(15) Reinforcement of research activities related to improvement of variety of livestock for promotion of paddy-livestock combined agriculture and the improvement of raising practice.

(16) Reinforcement of research and experimental activities related to securing the forage.

(17) Expansion and reinforcement of facilities and services required for improvement of animal sanitation.

(18) Improvement of processing practice of livestock products and establishment of processing system.

(19) Establishment of suitable system to extend the results of research and experimental activities.

Village Life Environmental Improvement & Reinforcement

(20) Establishment of measures to absorb the surplus labor which will appear due to labor-saving in agriculture.

(21) Promotion of agri-product processing industries for effective use of agricultural by-products.

(22) Establishment of measures for improving living environment to settle the rural population.

The above mentioned subject matters are often inter-related and their priority differs by the sub-areas in the Project Area in some cases, but the following projects are formulated taking the conditions of project implementation into consideration:

(a) Area Drainage Project

Related to item (3) of the above subject matters, it is formulated as one project considering the characteristics of the covering area of project and expected effects, but the project will be divided into 2 sites of right and left banks of the Haraz river at the implementation stage.

(b) Terminal Facilities Improvement Project

Related to items (4) (5) (6) of the above subject matters, these subjects are to be implemented taking the topography, hydrology, relation with main irrigation facilities, etc. by each sub-area into account, but these subjects are formulated as one project excluding the research/experimental subjects providing planning and design criteria as preconditions. The manner of project implementation is studied in the para. 5.5.3. below.

(c) Farming Practice/Farm Management Improvement Project

The items (7), (10) and (13) of the above subject matters are closely related to the above Terminal Facilities Improvement Project, experimental activities mentioned in the items (4) and (5) and, furthermore, the items (8), (9) (11) and (14), and these items are to be studied in two cases of before and after implementation of land improvement works. Therefore, these items including the item (19) are formulated as one project. This project mainly aims to study the facilities and systems required for expansion and reinforcement of research and experimental activities as well as extension of the results therefrom.

(d) Post Harvesting Improvement Project

Related to item (12) of the above subject matters, the subject is mainly concentrated on the improvement of rice milling practice and review of marketing system there to, therefore the item (12) is formulated as one separated project.

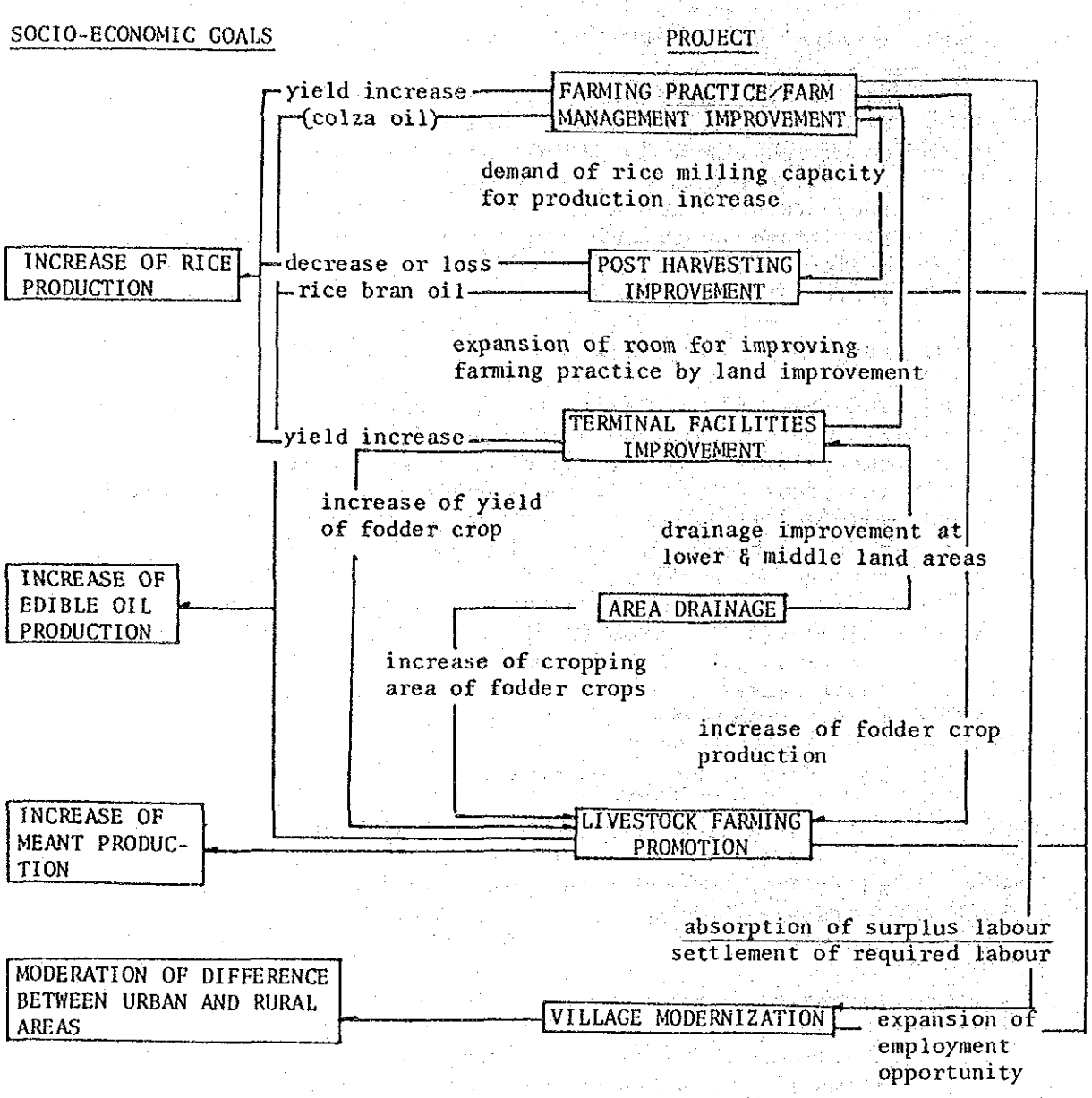
(e) Livestock Farming Promotion Project

The items (15) - (17) have different character with the items (3) - (14) which are centering around the crop cultivation, therefore items (15) - (17) are to be studied as one project.

(f) Village Modernization Project

The items (19) - (21) have not direct relation with agricultural production, therefore these items are formulated as one project.

Providing the above projects as preconditions, the interrelation and linkage amongst these projects around the socio-economic goals mentioned in the Section 4.2. are verified as the following chart:


SOCIO-ECONOMIC GOALS
PROJECT
yield increase
(colza oil)
FARMING PRACTICE/FARM MANAGEMENT IMPROVEMENT
demand of rice milling capacity for production increase
INCREASE OF RICE PRODUCTION
decrease or loss
rice bran oil
POST HARVESTING IMPROVEMENT
expansion of room for improving farming practice by land improvement
yield increase
TERMINAL FACILITIES IMPROVEMENT
increase of yield of fodder crop
drainage improvement at lower & middle land areas
INCREASE OF EDIBLE OIL PRODUCTION
AREA DRAINAGE
increase of cropping area of fodder crops
increase of fodder crop production
INCREASE OF MEANT PRODUCTION
LIVESTOCK FARMING PROMOTION
absorption of surplus labour
settlement of required labour
MODERATION OF DIFFERENCE BETWEEN URBAN AND RURAL AREAS
VILLAGE MODERNIZATION
expansion of employment opportunity

Namely, each project has a linkage with other projects to achieve its socio-economic goals, and, in case of separated implementation of specific project, it is not only causing the decrease of the effect of implementation, but there is some possibility to call unfavorable influence. Consequently, the conditions of implementation are to be carefully studied by the project clarifying the linkage with other projects as well as content of service to be provided, and as a mean of such study, preparation of the logical framework by project is recommendable.

Many methods are prevailing for preparing the logical framework, but that of Asian Development Bank is applied for this development plan.

That is such method as grasping the required subject matters to achieve the socio-economic goals by quality and quantity of the impact, changes therefrom (output) and project purpose, and clarifying the details thereof, then varifying required social and systematical conditions to materialize the required subject matters by stages. With preparation of such framework, the cause searching in the cases of delay of progress in the stage of project implementation and/or failure of achievement of expected benefit become easier, and furthermore, the forecast of achievement of the socio-economical goals prior to the project implementation will be available. The logical frameworks by each project are shown in the following para. 5.5.2 - 5.5.7.

5.5.2. Area Drainage Project

(1) Project Components

Though the present agriculture prevailing in the Project Area is paddy mono-culture, the mechanization of farming activities is requested to increase the yield of paddy, to introduce the second crops, and consequently to reduce the production cost of rice. For achieving these matters, the area drainage project is premised.

The Project Area is divided into two drainage areas, namely the Haraz Left Bank Drainage Area and the Haraz Right Bank Drainage Area including the Kari Rud Command. The area drainage project aims to provide the main drainage canals for resolving drainage problems in the middle and low land by the above said two drainage areas. Furthermore, this project also provides the roads along the main drainage canals to reinforce the present road network.

This project will be fully effective after completion of the terminal drainage implemented under the terminal facilities improvement project succeeding this project.

(2) Purpose of Project

The purposes of the project are 1) to dissolve the inundation of paddy by 50% and 2) to introduce the second crops at certain

areas by drainage improvement in the middle and low land. Furthermore, this project will have an impact upon the terminal facilities improvement project which is proposed to be implemented with the farmer's own expenses. The areas to be able to introduce the second crops are estimated conservatively at 15% of the whole paddy fields in the middle and low land.

(3) Method of the Project Implementation

The project will be implemented from the low land to the middle land under the governmental investment to remove the areal drainage problems in the areas more than 110 ha. As proposed in the para. 5.2.2, the countermeasures to the flood intrusion are to provide the flood protection dike along the Babol river (to be used also as the road), to improve the flood way from the Kari Rud to the Karan Rud against the Garma Rud and to restrict the land use for second crops against the Alesh Rud. On the other hand, the countermeasure to the rising of the Caspian Sea level is to set the expecting level at the recorded highest level at -25.3 m PGD. These countermeasures need further careful studies.

(4) Study Items for Project Implementation

For implementing this project, a feasibility study is necessary including the hydrological study on the above three rivers and the Caspian Sea.

1) Installation of the rain-recorders (attached with the heater) and the water stage recorders in the basins of the Garma Rud and the Alesh Rud.

2) Improvement of the tide recorder at Khazarshahr.

3) Survey on the sub-surface groundwater table and the hydraulic conductivity.

4) Preparation of the complete irrigation and drainage network map and the topographical map especially at the low land of the Kari Rud Command and at the forest lands located at the right bank tract of the Alesh Rud and at the east of Amol-Mohamud Abad road. The existing topographical map (1:20,000 in 1968) may be used in the feasibility study, but the bench mark network in the Project Area is to be renovated because most of previously installed bench marks are removed off.

5) Longitudinal and cross-sectional survey of the Babol river, the Kari Rud, the flood way from the Kari Rud to the Karan Rud, the Alesh Rud and the Haraz river below Razkeh. Furthermore, cross-sectional survey of the irrigation-cum-drainage canals at key locations, longitudinal and cross-sectional survey of the lower reaches of the drainage channels to the Caspian Sea and depth sounding of the major abbandans.

LOGICAL FRAMEWORK OF THE AREA DRAINAGE PROJECT FOR THE HARAZ LEFT BANK DRAINAGE AREA

SOCIO-ECONOMIC GOALS

1. Contribution in self-sufficient supply of rice.
2. Contribution in self-sufficient supply of edible oil.
3. Contribution in self-sufficient supply of meat.

MEASURES GOAL ACHIEVEMENT

1. Increase of the rice productivity by dissolution of the inundation 5.8 t/ha → 7.0 t/ha
2. Increase of Cows head
   (i) Increase of butter production t/year
   (ii) Increase of meat production t/year

NECESSARY ASSUMPTIONS for GOALS

1. Supply of the seeds of the improved rice varieties.
2. Establishment of the policy on rice price.
3. Supply of the seeds of berseem.
4. Implementation of the animal husbandry promotion project.
5. Promotion of the farming cooperation by reinforcing the agricultural cooperatives.

if PURPOSES plus ASSUMPTIONS, then GOALS

PROJECT PURPOSES

1. Increase of the rice productivity by dissolution of the inundation.
2. Increase of the acreage of berseem by dissolution of the inundation in autumn and winter.
3. Increase of the production of berseem by above measure.

END-of-PROJECT STATUS

1. Dissolution of the inundation for rice 3,015 ha
2. Dissolution of the inundation for berseem 2,690 ha
3. Increase of the production of berseem 2,690 ha

NECESSARY ASSUMPTIONS for PURPOSES

1. Implementation of the area drainage under the governmental investment
2. Implementation of the flood control of the Alesh Rud including the river training. (Implementation will depend on the future study. This study is not expecting the implementation in early stage.)
3. Improvement of the terminal drainage system.
4. Extension on the proper water depth for paddy.
5. Reinforcement of the extension work for the second crops.
6. Establishing the O & M system.

if OUTPUTS plus ASSUMPTIONS, then PURPOSES

PROJECT OUTPUTS

1. Area Drainage System
   (i) The main and lateral drainage canals and the maintenance roads.
   (ii) Improvement of the existing abbandan's

COMPONENTS and QUANTITIES

1. Main and lateral drainage canals 191 km
2. Maintenance roads 191 km
3. Bridges 234 plcs
4. Drops 120 plcs
5. Check gates 22 plcs
6. Spillway and improvement of the abbandans 52 plcs

NECESSARY ASSUMPTIONS for OUTPUTS

1. Coordination between the MOA and the MOE on the area drainage project and the flood control.
2. Preparation of the governmental investment and its schedule.
3. Consulting services.
4. Selection and contract of the contractors.

if INPUTS plus ASSUMPTIONS, then OUTPUTS

PROJECT INPUTS

1. Preparation of the topographical map (1:5,000)		399 km²
2. Survey of the canal alignment		191 km
3. Sounding of the abbandans		52 plcs
4. Soil survey (Hydraulic conductivity, soil bearing etc.)		
5. Runoff observation of the Alesh Rud		
6. Survey of the rivers		20 km
7. Consulting services	F/S	30 man.month
	D/D	60 man.month
	Supervising	40 man.month
8. Land acquisition		340 ha

COSTS and SCHEDULE

WORK ITEMS	Cost (10^6 Rials)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. Survey	157	———	———	———							
2. F/S, D/D	110	———		———							
3. Supervising	50				———	———	———				
4. Construction of Drainage Canal	1,806				———	———	———				
5. Construction of Apertenant Structures	309					———	———				
Total	2,432										

LOGICAL FRAMEWORK OF THE AREA DRAINAGE PROJECT FOR THE HARAZ RIGHT BANK DRAINAGE AREA

SOCIO-ECONOMIC GOALS	MEASURES GOAL ACHIEVEMENT	NECESSARY ASSUMPTIONS for GOALS
1. Contribution in self-sufficient supply of rice. 2. Contribution in self-sufficient supply of edible oil. 3. Contribution in self-sufficient supply of meat.	1. Increase of the rice productivity by dissolution of the inundation 5.8 t/ha → 7.0 t/ha 2. Increase of Cows head (i) Increase of butter production t/ha (ii) Increase of meat production t/ha	1. Supply of the seeds of the improved rice varieties. 2. Establishment of the policy on the rice price. 3. Supply of the seeds of berseem. 4. Implementation of the animal husbandry promotion project. 5. Promotion of the farming cooperation by reinforcing the agricultural cooperatives.

if PURPOSES plus ASSUMPTIONS, then GOALS

PROJECT PURPOSES	END-of-PROJECT STATUS	NECESSARY ASSUMPTIONS for PURPOSES
1. Increase of the rice productivity by dissolution of the inundation. 2. Ensuring the production of second crops by dissolution of floods from the Babol river and the Kari Rud. 3. Increase of the acreage of berseem by dissolution of the inundation in autumn and winter. 4. Increase of the production of berseem by above measure.	1. Dissolution of the inundation for rice 10,060 ha 2. Dissolution of the inundation for berseem 3,210 ha 3. Increase of the production of berseem 3,210 ha	1. Implementation of the area drainage under the governmental investment. 2. Implementation of the flood control (including the construction of multi-purpose dams) of the Babol river and the Garma Rud. (Implementation will depend on the future study.) 3. Improvement to the terminal drainage system. 4. Extension on the proper water depth for paddy. 5. Reinforcement of the extension work for the second crops. 6. Establishing the O & M system.

if OUTPUTS plus ASSUMPTIONS, then PURPOSES

PROJECT OUTPUTS	COMPONENTS and QUANTITIES	NECESSARY ASSUMPTIONS for OUTPUTS
1. Area Drainage System (i) The main and laterial drainage canals and the maintenance roads. (ii) Improvement of the existing abbandans. 2. Flood Control System (i) Flood protection dike of the Babol Rud. (ii) Improvement of the floodway of the Kari Rud.	1. Main and lateral drainage canals 319 km 2. Maintenance roads 319 km 3. Bridges 150 plcs 4. Drops 120 plcs 5. Check gates 33 plcs 6. Spillway and improvement of the abbandans 86 plcs 7. Flood protection dike of the Babol River 21 km 8. Kari Rud floodway (including the Waste Way) 2 km	1. Coordination between the MOA and the MOE on the area drainage project and the flood control. 2. Preparation of the governmental investment and its schedule. 3. Consulting services. 4. Selection and contract of the contractors.

if INPUTS plus ASSUMPTIONS, then OUTPUTS

PROJECT INPUTS		
1. Preparation of the topographical map (1:5,000)		645 km²
2. Survey of the canal alignment		320 km
3. Sounding of the abbandans		86 plcs
4. Soil survey (Hydraulic conductivity, soil bearing etc.)		
5. Runoff observation of the Garma Rud		
6. Survey of the rivers		33 km
7. Consulting services	F/S	75 man.month
	D/D	135 man.month
	Supervising	90 man.month
8. Land acquisition		680 ha

COSTS and SCHEDULE

WORK ITEMS	Cost (10^6 Rials)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. Survey	415	----	----								
2. F/S, D/D	250	——	——								
3. Supervising	110				——	——	——				
4. Construction of Drainage Canal	4,504				——	——	——				
5. Construction of Apertenant Structures	665				——	——	——				
Total	5,944										

6) Survey and study on stabilization of the sand dunes

7) Quantitative survey on inundation (depth, area and duration) and its damages. (including preparation of the inundation map by survey and interview)

8) Quantitative survey on flood intrusion (section, depth and duration of overtopping including the flood intrusion through the secondary irrigation canals) and its damages including the damages other than agricultural damage.

9) Data collection on hydrological aspects of the transfer basin of the Volga.

10) Feasibility study including the countermeasures to the floods, rising of the Caspian Sea and the sand dunes.

Other than the above, it is necessary to research the effects by drainage improvement and to prepare improvement criteria. This work will be undertaken as a part of agricultural research and experimental activities.

Furthermore, it is necessary to prepare the detailed topographical map (1:5,000) and to survey the all drainage alignments and the abbandans at the stage of detailed design.

5.5.3. Terminal Facilities Improvement Project

(1) Project Components

Since it is going to reach the limitation of water and land resource in the Project Area, stabilization and increase of productivity are strongly desired by increasing the land use under effective use of water resources. Furthermore, mechanization of farming is also requested to decrease the production cost of rice. For achieving the above, it is necessary to provide drastical improvement on the cultivated land.

For realization, the terminal facilities improvement project has to be implemented to proceed the consolidation which is composed of land readjustment, land leveling, provision of farm roads and terminal irrigation and drainage canals. On the other hand, the main irrigation canal improvement project is also to be implemented to proceed improvement of the irrigation facilities centering at the intakes and the division works. Since the existing irrigation networks are presently working on their ways, the implementation of the terminal facilities improvement project is not necessarily to wait for the completion of the main irrigation canal improvement project. Furthermore, realignment of the main irrigation canals is not recommended, so the present canal alignment remains. Consequently, the terminal facilities improvement project will be able to be implemented simultaneously with or independently from the main irrigation canal improvement project. However, the proper water distribution has to be realized before the completion of the terminal facilities improvement project in the whole area. The main irrigation canal improvement project is, therefore, to be commenced prior to the completion of the terminal facilities improvement project in the whole area.

(2) Purpose of Project

The terminal facilities improvement project is composed of land consolidation and tile drainage. The land consolidation aims to introduce the agricultural machinery for farming, to increase the rice production by realization of proper water management at terminal level and to introduce the second crops by improvement of terminal drainage. On the other hand, the tile drainage aims to ensure the target yield of the second crops.

(3) Method of the Project Implementation

Since the project has less possibility to be implemented by the governmental investment, it will be implemented with the farmer's own expenses. This project, however, has to be supported by the MOA on survey, planning and design. Furthermore, the implementation of the pilot project is necessary to accelerate the farmers' investment.

These supporting services will be proceeded by CAPIC (ref. para. 5.5.10 below) including training of the engineers for land consolidation.

(4) Study Items for Project Implementation

For implementing this project, the following feasibility study is necessary. And, it is desired to take the aerophotos before the implementation of the feasibility study.

1) Survey of Present Terminal Blocks

Selecting one representative secondary irrigation network in each irrigation command area (Haraz Left Bank, Haraz Right Bank and Kari Rud), the present terminal blocks will be surveyed in each representative network with help of the topographical map of 1:20,000 and the irrigation and drainage network map which will be prepared in the feasibility study for the area drainage project. When the aerophotos are taken, these should be used in this survey.

The survey items are as follows;

i) Boundary, paddy area, water right acreage, area by water source of each terminal block.

ii) Location of farm roads and terminal irrigation and drainage ditches in each terminal block.

iii) Condition of irrigation and drainage in each terminal block.

iv) Farm management survey in each terminal block.

In the other networks than the representative one, the boundary of the terminal blocks will be surveyed.

2) Selection of Sample Areas

One sample area will be selected in each sub-area after the survey of item 1).

3) Preparation of the Topographical Map of Sample Areas

The topographical map will be prepared in each sample area in the scale of 1:1,000.

4) Preparation of the Cadastral Map of Sample Areas (including the water right)

5) Soil Survey including Soil Bearing and the Hydraulic Conductivity reinforcing the survey on sub-surface groundwater table and hydraulic conductivity by the area drainage project

6) Survey on Water Requirement and Irrigation Efficiency at the Terminal Level

This survey will be conducted in selected sample areas.

LOGICAL FRAMEWORK OF THE TERMINAL FACILITIES IMPROVEMENT PROJECT FOR THE HIGH LAND

SOCIO-ECONOMIC GOALS

1. Contribution in self-sufficient supply of rice.
2. Contribution in self-sufficient supply of edible oil.
3. Contribution in self-sufficient supply of meat.

MEASURES GOAL ACHIEVEMENT

1. Increase of the rice productivity by improving the irrigation and drainage conditions.
   (i) Improved varieties 6.7 t/ha → 8.4 t/ha
   (ii) Local varieties 3.5 t/ha → 4.2 t/ha
2. Increase of the land use by means of introduction of the second crops. 90 % → 160 %
3. Elumination of labour by means of effective mechanization.
   (i) Improved varieties 1,274 hr/ha → 746 hr/ha
   (ii) Local varieties 1,119 hr/ha → 612 hr/ha

NECESSARY ASSUMPTIONS for GOALS

1. Development of the new varieties. (cool weather resistant)
2. Establishment of the policy on rice price.
3. Supply of the seeds of berseem.
4. Implementation of the farming practice farm management improvement project and the animal husbandry promoting project.
5. Promotion of the farming cooperation by reinforcing the agricultural cooperatives.
6. Improvement of the marketing system by reinforcing the agricultural cooperatives.

if PURPOSES plus ASSUMPTIONS, then GOALS

PROJECT PURPOSES

1. Reduction of the rice production cost by means of mechanization.
2. Increase and stabilization of the productivity by means of improvement of the terminal irrigation and drainage ditches.
3. Increase of the efficiency of machinery by means of the land readjustment.
4. Perfect pest control by proper provision of the farm roads.
5. Acceleration of farmers' intension to introduce the second crops and the animal husbandry by decreasing the labour in rice farming.

END-of-PROJECT STATUS

1. Mechanization of paddy fields	20,270 ha
2. Introduction of berseem as the second crop	10,140 ha
3. Introduction of vegetables as the second crop	2,300 ha
4. Crop intensity by aboves	160 %

NECESSARY ASSUMPTIONS for PURPOSES

1. Procurement of the necessary agricultural machinery.
2. Implementation of the main irrigation canal improvement project.
3. Reinforcing and establishing the water management and the O&M systems.

if OUTPUTS plus ASSUMPTIONS, then PURPOSES

PROJECT OUTPUTS

1. Pilot projects for land consolidation	3 projects
2. Land consolidation	

COMPONENTS and QUANTITIES

1. Land consolidation for the pilot project	330 ha
2. Land consolidation	
(i) Land readjustment	19,940 ha
(ii) Farm road	1,095 km
(iii) Irrigation ditches	885 km
(iv) Drainage ditches	195 km

NECESSARY ASSUMPTIONS for OUTPUTS

1. Extension to the farmers by implementing the pilot projects after feasibility study.
2. Establishment of the regulations such as on subsidy and credit for the land consolidation.
3. Coordination between the MOA and the MOE on the main irrigation canal improvement project.
4. Training the staffs for sevicing on the detailed design (including the farm plot survey) and the supervision for land consolidation.
5. Organizing the land improvement districts for land consolidation.

if INPUTS plus ASSUMPTIONS, then OUTPUTS

PROJECT INPUTS

1. Preparation of the topographical map	(1:1,000)	28,820 ha
2. Preparation of the cadastral map	(1:1,000)	21,180 ha
3. Consulting services F/S		155 man.month
D/D *		280 man.month
Supervising **		190 man.month

* including the detailed design of the pilot project.

** supervising for the first 5 years. (exclusing the site supervision.)

COSTS and SCHEDULE

WORK ITEMS	Cost (10^6 Rials)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. Survey	820										
2. F/S, D/D	525										
3. Supervising	225										
4. Pilot Project	146										
5. Land Consolidation	10,392										
Total	12,008										

LOGICAL FRAMEWORK OF THE TERMINAL FACILITIES IMPROVEMENT PROJECT FOR THE MIDDLE AND THE LOW LAND

SOCIO-ECONOMIC GOALS

1. Contribution in self-sufficient supply of rice.
2. Contribution in self-sufficient supply of edible oil.
3. Contribution in self-sufficient supply of meat.

MEASURES GOAL ACHIEVEMENT

1. *Increase of the rice productivity by improving* the irrigation and drainage conditions.
   (i) Improved varieties 6.7 t/ha → 8.4 t/ha
   (ii) Local varieties 3.5 t/ha → 4.2 t/ha
2. Increase of the land use by means fo introduction of the second crops. 95 % → 150 %
3. Elumination of labour by means of effective mechanization.
   (i) Improved varieties 1,274 hr/ha → 746 hr/ha
   (ii) Local varieties 1,119 hr/ha → 612 hr/ha

NECESSARY ASSUMPTIONS for GOALS

1. Establishment of the policy on rice price.
2. Supply of the seeds of berseem.
3. *Implementation of the farming practice* farm management improvement project and the animal husbandry promoting project.
4. *Promotion of the farming cooperation* by reinforcing the agricultural cooperatives.
5. *Improvement of the marketing system* by reinforcing the agricultural cooperatives.

if PURPOSES plus ASSUMPTIONS, then GOALS

PROJECT PURPOSES

1. Reduction of the rice production cost by *means of mechanization.*
2. Increase and stabilization of the productivity by means of improvement of the terminal *irrigation and drainage ditches.*
3. Increase of the efficiency of machinery by means of the land readjustment.
4. Perfect pest control by-proper provision of the farm roads.
5. Acceleration of farmers' intension to introduce the *second crops and* the animal husbandry by decreasing the labour in rice farming.

END-of-PROJECT STATUS

1. Mechanization of paddy fields 48,190 ha
2. Introduction of berseem as the second crop. 24,100 ha
3. Introduction of vegetables as the second crop. —
4. Crop intensity by aboves. 150 %

NECESSARY ASSUMPTIONS for PURPOSES

1. Procurement of the necessary agricultural machinery.
2. Implementation of the main irrigation canal improvement project.
3. Reinforcing and establishing the water management and the O & M systems.

if OUTPUTS plus ASSUMPTIONS, then PURPOSES

PROJECT OUTPUTS

1. Pilot projects for land consolidation. 6 projects
2. Land consolidation
3. Tile drainage

COMPONENTS and QUANTITIES

1. *Land consolidation* for the pilot project 660 ha
2. Land consolidation
   (i) *Land readjustment* 47,530 ha
   (ii) Farm road 2,980 km
   (iii) Irrigation ditches 2,195 km
   (iv) Drainage ditches 2,080 km
3. Tile drainage 24,095 km

NECESSARY ASSUMPTIONS for OUTPUTS

1. Extension to the farmers by implementing the pilot projects after feasibility study.
2. Establishment of the regulations such as on subsidy and credit for the land consolidation.
3. Prior implementation of the area drainage project.
4. Coordination between the MOA and the MOE on the main irrigation canal improvement project.
5. Training the staffs for sevicing on the detailed design (including the farm plot survey) and the supervision for land consolidation.
6. Organizing the land improvement districts for land consolidation.

if INPUTS plus ASSUMPTIONS, then OUTPUTS

PROJECT INPUTS

1. Preparation of the topographical map(1:1,000) 75,540 ha
2. Preparation of the cadastral mpa (1:1,000) 51,430 ha
3. Consulting services
   F/S 370 man.month
   D/D * 670 man.month
   Supervising ** 450 man.month

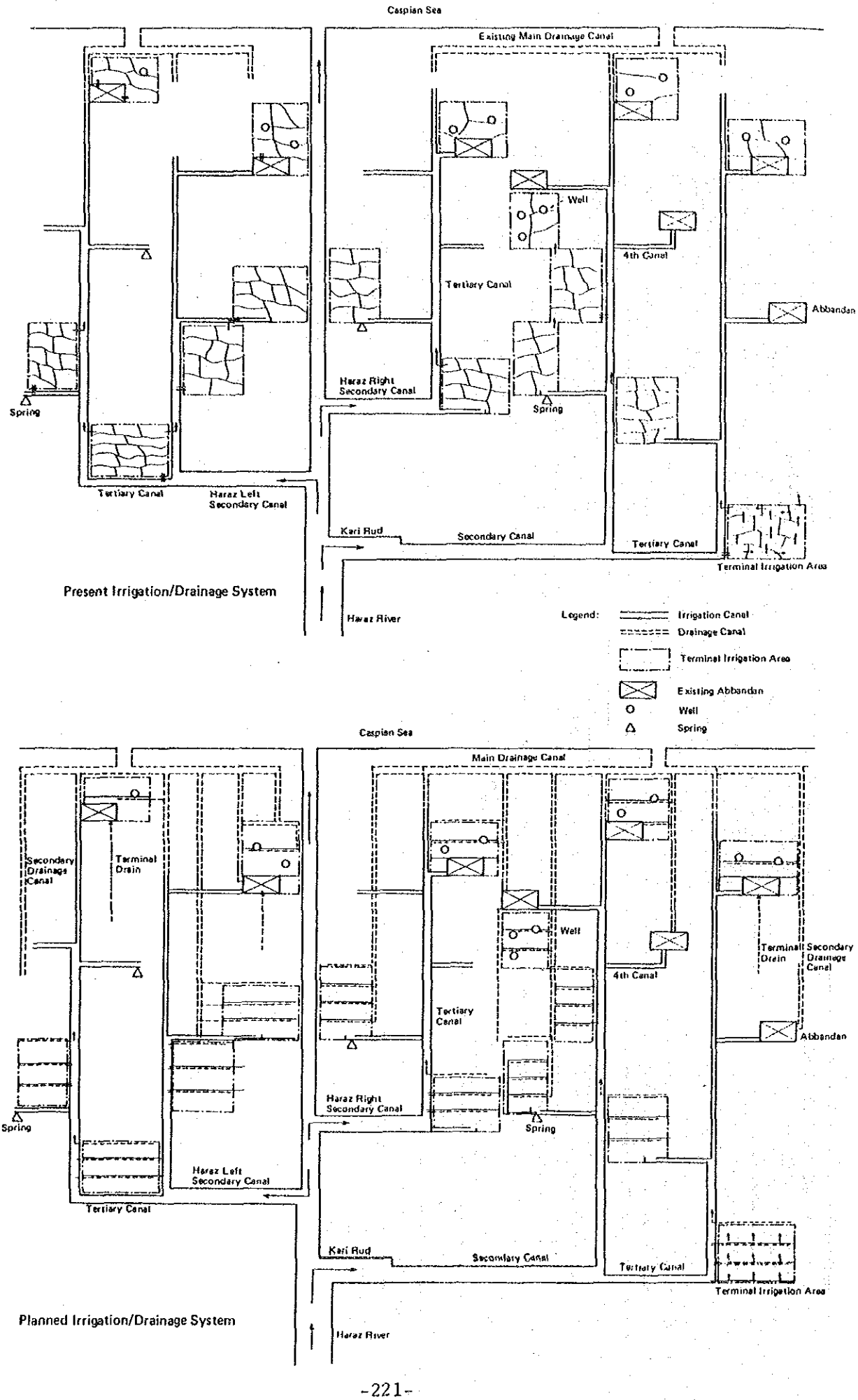
* *including* the detailed design of the pilot projects.

** supervising for the first 5 years. (exclusing the site supervision)

COSTS and SCHEDULE

WORK ITEMS	Cost (10^6 Rials)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. Survey	1,910	—	—	—	—	—	—	—			
2. F/S, D/D	1,250	—	—	—	—	—	—	—	—	—	—
3. Supervising	540				—	—	—	—	—	—	—
4. Pilot Project	290					—	—	—			
5. Land Consolidation	24,396								—	—	—
Total	28,390										

Exhibit 5.5.1 Schematic Layout of Present and Planned Irrigation/Drainage System



7) Estimation of Present and Future Water Requirement at the Terminal Level.

Future water requirement has to be estimated considering the increase of percolation by terminal drainage improvement.

8) Layout of the Land Consolidation in Sample Areas

The cost has to be estimated by the layout.

9) Feasibility Study

Selection of the areas and their implementation schedule have to be prepared with priority. Furthermore, the areas of the pilot project will be selected. The outline of the design criteria of land consolidation will be prepared in this study.

After the feasibility study, the main irrigation canal improvement project is expected to proceed to the detailed design and to the implementation immediately.

The schematic layout of present irrigation/drainage system and that of planned system as above mentioned "Area Drainage and Terminal Facilities Improvement Projects" are shown as Exhibit 5.5.1. And the land consolidation works are to be carried out at the terminal areas shown in the Figure as Terminal Irrigation Area.

For the land consolidation, the pilot project has to be implemented after its detailed design. Furthermore, the extension services for land consolidation have to be promoted with priority for implementation. The land consolidation will be implemented at the request of farmers, and the detailed topographical map (1:1,000) and the cadastral map will be prepared in the blocks requested. The implementation block is defined basically in accordance with the definition by the feasibility study.

The necessity of tile drainage will be examined by the detailed soil survey in each block. When it is necessary, detailed dimensions will be studied. It is recommended to examine the effects of tile drainage in the pilot project.

Other than the above, the research on the efficiency of agricultural machinery by soil and farm plot size will be conducted in the measures for reinforcing agricultural research and experimental activities. And, CAPIC will conduct to prepare the design criteria and law, to train the engineers and to implement the pilot project for land consolidation.

As a reference, the necessary survey items are described in Appendix E.1.

5.5.4. Farming Practice/Farm Management Improvement Project

(1) Project Components

The implementation at the Area and Terminal Facilities Improvement Projects will change the agricultural basis in the Project Area to a considerable extent, and accelerate the application of more completely equipped agriculture, but the improvement of farming practice and farm management system are required responding or preceding to the implementation of these projects, and, furthermore, the improvement and reinforcement of relative supporting institutions are required. This project is to study:

- possibilities of increase of productivities by means of improvement of farming practice on the existing agricultural basis,
- method of introduction of advanced technology responding to the improvement of facilities,
- manner of reinforcement of required supporting institutions such as research/experiment, extension, etc. and other factors considering such requirement.

(2) Purpose of Project

The purpose of this project is to realize the increase of productivity providing appropriate measures therefor.

The mean yield of paddy in the Project Area is rather high, but it is considered that rather large room of increase of mean yield by the improvement of farming practice is still remaining taking the large fluctuation of yield in a same district into account. Furthermore, new demand on seed improvement and/or farming practice will appear at the stage of materialization of farm mechanization responding to the improvement at terminal facilities, and many improvement related to the introduction of second crops will also be required. Moreover, the review of farm management is un-negligible when the livestock farming is developed to such extent of the economically unavoidable activities introducing the cultivation of fodder crops as second crops. These subjects are to be studied within the framework of this project.

(3) Method of Project Implementation

This project is basically carried out with such procedures of Survey - Research/Experiment - Extension. Among them, most incomplete one at present is the Survey. Namely, the Research/Experiment and Extension Services have been arranged systematically and already obtaining good results, but metrical survey on the actual situation of farming practice applied by the farmer have not been undertaken sufficiently, and, especially, the relation between applied farming practice and its results with the

LOGICAL FRAMEWORK OF FARMING PRACTICE/FARM MANAGEMENT IMPROVEMENT PROJECT

SOCIO-ECONOMIC GOALS

1. Contribution in self-sufficient supply of rice.
2. Contribution in self-sufficient supply of edible oil.
3. Contribution in self-sufficient supply of meat.

MEASURES GOAL ACHIEVEMENT

1. Increase of mean yield by mean of farming practice improvement		
a) *Improved variety*	6.7 t/ha	8.4 t/ha
b) Local variety	3.5 t/ha	4.2 t/ha
2. Increase of material bran for rice bran oil extraction	18,500t	23,000t
3. Increase of yield of fodder crop by mean of farming practice improvement	30t/ha	60 t/ha
4. *Introduction of suitable oil seed crops.*		

NECESSARY ASSUMPTIONS for GOALS

1. Creation & extension of high yield variety with better marketability.
2. Establishment at pricing policy of rice.

if PURPOSES plus ASSUMPTIONS, then GOALS

PROJECT PURPOSES

1. Increase of yield of paddy by mean of improvement of farming practice.
2. Extension of advanced practice responding to farm mechanization such as cooperative nursery facilities.
3. Selection of suitable second crops and increase of their yield.
4. Increase of farmer's income by mean of extension of paddy-livestock combined agriculture.

END-of-PROJECT STATUS

1. Cropping rate of paddy		
a) Improved variety	60%	80%
b) Local variety	40%	20%
2. Total Production of Paddy	370,000t/annum	460,000 t/annum
3. Farmer's Income		
a) Paddy-culture		
b) Livestock farming		

NECESSARY ASSUMPTIONS for PURPOSES

1. To provide necessary tools and material for model farm together with proper services.
2. Analysis of climate-yield relation by districts for each crop and selection of suitable cropping calendar based on such analysis.
3. Implementation of Area Drainage Project at Low and Middle Lands.
4. Implementation at Terminal *Facilities Improvement Project for Whole Area.* Especially, early implementation of pilot projects.
5. Implementation of Livestock Farming Improvement Project.
6. Enlightenment at farmer for introducing cooperative *farming work system.*

if OUTPUTS plus ASSUMPTIONS, then *PURPOSES*

PROJECT OUTPUTS

1. Model farms
2. Seed multiplication center for paddy
3. Cooperative nursery facilities
4. Country elevator
5. Forecast/protection system for pest/insect damage

COMPONENTS and QUANTITIES

1. Model Farm	
a) Land consolidated areas	125 ha x 9 sites
b) Non-consolidated land area	5 ha x 18 sites
2. Seed multiplication center	1 place
3. Cooperative nursery facilities	1 place per 125 ha
4. Country-elevator	1 place per 1,000 ha
5. Forecast/Protection System for pest/insect damage	
a) Forecast/observation station	14 places
b) Control center	one per each RSC

NECESSARY ASSUMPTIONS for OUTPUTS

1. Early establishment of ARTSC in Amol Shahrestan.
2. Execution of experimental nursery preparation for mechanized transplanting at Amol Rice Research Station and training of technician of nursery preparation.
3. Collection of quality seeds of paddy including *local varieties and execution* of cropping test in Amol Rice Research Station.
4. Area-wide survey of actual situation of pest/insect damages.
5. *Training of extension crew and specialists.*

if INPUTS plus ASSUMPTIONS, then OUTPUTS

PROJECT INPUTS

1. Soil survey & mapping in semi-detailed level		105,000 ha
2. Establishment of meteorological observation stations		4 places
3. Consulting Services	F/S	50 man.month
	D/D	50 man.month
4. Staff of Research & Experimental activities		as adequate
5. Extension Staff		as adequate

COSTS and SCHEDULE

WORK ITEMS	Cost (10^6 Rials)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. Soil Survey											
2. Establishment of meteorological observation network											
3. F/S											
4. D/D (for model farm, only standard designs)											
5. Execution of seed multiplication center											
6. Pilot facilities of nursery preparation and country elevation											
7. Establishment of Forecast/prevention System of pest/insect damage											
8. Establishment of Model Farms											