

<b>Annex 8</b>	<b>Scenario of Agriculture Development in Gorgan Plain and Agriculture Development of Priority Areas</b>
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## ANNEX 8

### SCENARIO OF AGRICULTURE DEVELOPMENT IN GORGAN PLAIN AND AGRICULTURE DEVELOPMENT OF PRIORITY AREAS

#### A8.1 Scenario of Agricultural Development in Gorgan Plain

##### A8.1.1 Main Aspects of Agricultural Development Planning

The development of irrigation water source is the precondition for the agricultural development in the Study Area. The development of water source can be done in short, middle and long-term plans. In order to achieve the targets, establishment and execution of the plans on the following items are required.

1. Basic pattern of crop rotation for extricating from gamble farming should be established in a short-term plan, and it should be extended and included in a medium term plan. The crop rotation would be fixed in a long-term plan. The basic pattern of the crop rotation includes annual leguminous pastures and annual grass besides cereals, cotton, rape seeds, and soybeans in order to increase organic matter of soil. It intends to improve the physical characteristics of heavy textured soil in this area and saving chemical fertilizers and pesticides. According to national policy, increase of wheat and oilseeds production need to be focused.
2. Integrated farming with livestock farming which is intended by farmers needs to be established through introducing pastures into a crop rotation, and establishment and extension of the method of making silage and hay of grass in order to use them in dry season. Moreover, livestock farming is promoted through planning of the increase of milk production, the hygienic management, and the construction of milk processing factories. Promotion of livestock farming completely consists with the idea of the basic crop rotation for sustainable agriculture in this plan.
3. Establishment of low cost irrigation and drainage methods.
4. Systematic improvement of finance and assistance for farmers should be executed according to the plan, and the system for planning and executing by local administrations also should be established.
5. Construction and improvement of social infrastructure. Construction and improvement plan and its execution of roads, storehouses, and processing factories should be proceeded simultaneously.
6. Improvement of marketing system is required according to the plan.
7. Supply system of farm materials, fuels, and agricultural machinery should be improved to supply them to farmers in time. In order to operate high technique effectively, timely farm

work is important. It should be improved according to the plan.

8. Strengthening of extension agencies should be promoted according to the plan. Especially, extension of production of forage for domestic animals, methods of making silage and hay, and hygienic management of dairy cattle are not enough. This technical extension contributes much to escape from gamble farming. It is proposed that local TV stations have the programs on agriculture and animal husbandry to broadcast market information on agricultural and livestock products and technical information. It must be effective.
9. Technical research supports all of the plans mentioned above. The research sectors, such as irrigation and drainage, soil improvement, sustainable crop rotation, making methods of silage and hay of grass, etc., and provincial government should carry out the integrated technological research.

By executing the plans mentioned above, it is sure to increase the possibility of agricultural development in the Study Area. Suitable measures should also be setup to secure sufficient water resources for the agricultural production in the Gorgan plain. A 'Phased Development Approach' is necessary to realize the actual measures to be carried out for the agriculture development as mentioned below.

(1) Expected countermeasures

- 1) Water Resources Aspects : To secure sufficient amount of water resources for a wide range of agriculture development.

Absolute shortage and instability of available water resources are the main problems of the Gorgan plain. The potential measures are as follows:

- |  |                     |
|--|---------------------|
| a. To provide farm ponds to store river water of wet season by scheme                  | Short Term          |
| b. To provide regional water distribution system from the Piedmonts region to the area | Medium Term         |
| c. To generate availability of water by the rationalization of dam operation           | Short & Medium Term |
| d. To proceed watershed management including reforestation of upstream area            | Medium & Long Term  |
| e. To conduct river bed stabilization to enhance normal pump intake                    | Short & Medium Term |
| f. To clarify hydrological circulation & appropriate water allocation by sectors       | Short & Medium Term |
| g. To examine inter-province water conveyance  | Medium & Long Term  |
| h. To extend water saving irrigation practice in the basins                            | Short & Medium Term |

2) Soil Aspects : To promote leaching of salts, and to improve poor fertility

The soils in the Gorgan plain areas contain high quantity of salt and are poor in fertility. Therefore, suitable soil and water management practices are necessary to get rid of salt hazards and to enrich soil fertility. The measures to be carried out in consideration of these aspects are as follows:

- a. To secure sufficient irrigation water to leach out salts      Short, Medium & Long Term
- b. To introduce improved farm program to enrich soil.      Short, Medium & Long Term
- c. To provide permanent drainage system to avoid salt hazard      Medium & Long Term
- d. To provide drainage networks in areas with high Potential for inundation      Short Term
- e. To provide economical mole drains to control groundwater level      Short & Medium Term
- f. To conduct soil monitoring      Short, Medium & Long Term

3) Socio-Economic Aspects: To provide and implement agricultural policies acceptable by the farmers and to realize inter agencial Government's assistances.

Most of the farmers, especially in the plain, have quite huge debts due to the instable production and low market prices of the products, even though both farmers and the governments have been making efforts to reconstruct the country after the revolution and the war. It is observed that the number of farmers leaving their farms is increasing and it will continue, if proper measures are not carried out to release their heavy burden. Measures based on these considerations are as follows:

- a. To start R&D on sustainable agriculture to improve farm income      Short Term
- b. To examine & implement promotion programs to increase farmers' willingness.      Short & Medium Term
- c. To introduce proper scale farming capable to maintain a better life      Medium & Long Term
- d. To rationalize administrative procedures and qualify assistances sufficient enough to eliminate farmers' distrust.      Medium & Long Term
- e. To conduct debt relief assistances to farmers      Medium & Long Term
- f. To promote programs to avoid traditional land tenure customs, which cause farm poverty due to land subdivision      Short Term

4) Agriculture Aspects : To establish proper farming programs to cope up with the conditions of the plain area, not only imitating those practices of the piedmont plain.

Irrigated agriculture has been introduced in the plain areas to realize high productivity

farming with high water consumption, without proper consideration of the natural conditions and traditional culture of the farmers in the region. Also, the farmers in the plain area utilize similar agro-practices of the piedmonts using the groundwater to get the necessary water. Hence, it can be said that the approaches alienate from the natural conditions and livestock based cultures. Measures to be carried out considering these aspects are as follows:

- |   |                     |
|---|---------------------|
| a. Agricultural program harmonized with livestock, pasture land farming and dry farming is to be examined to cope up with the natural conditions of the plain | Short & Medium Term |
| b. To distinguish areas that can be irrigated to avoid instable irrigation water supply   | Short & Medium Term |
| c. To establish the government assistance programs to realize stable crop selling   | Medium & Long Term  |
| d. To examine concrete plans to secure sufficient water sources for a stable water use  | Medium & Long Term  |
| e. To provide permanent drainage system capable to leach out salts  | Medium & Long Term  |

5) Irrigation and Drainage Aspects : Towards stable water use and relief from salt hazards.

It must be recognized that the present water resources are far from sufficiency to promote irrigated agriculture. Besides, there is a high risk potential of salinization problems. Measures should be carried out, based on the above mentioned considerations are as follows:

- |  |                           |
|--|---------------------------|
| a. To secure sufficient irrigation water to leach out salts            | Short, Medium & Long Term |
| b. To provide permanent drainage system to avoid salinization problems | Short, Medium & Long Term |
| c. To promote water saving irrigation practices in the basins          | Short & Medium Term       |
| d. To provide farm ponds to secure stable water use in dry season      | Short & Medium Term       |
| e. To provide drainage networks for inundation potential areas         | Short Term                |
| f. To provide economical mole drains to control groundwater level      | Short & Medium Term       |

(2) Necessity of Phased Development Planning as Basic Concept for Agricultural Development in the Plain

It is obvious that all the measures listed in the previous section can not be implemented in one time, and it is not appropriate to do so. They have to be prioritized and synchronized between each other. With this understanding, a ‘Phased Development Approach’ is to be set as a basic concept for planning the agricultural development in the Study Area.

**A8.1.2 Scenario of Agricultural Development**

The scenario of agricultural development in Gorgan plain is developed plain based on the discussions with government agencies and farmers, including their intentions and opinions to

promote a sustainable agricultural development in Gorgan plain.

(1) Phasing Alternative

Tentatively 3 phases with 5-year period for each stage are proposed, starting in 2005, considering that this Study will be finished in spring 2003. Those stages are as follows:

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

(2) Preparatory stage From the spring of 2003 to the end of 2004 (2 years)

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

(3) Phase-1 from 2005 to 2009 (5 years)

This phase is to be set as a period of “Preparation for Sustainable Agricultural Development and Rural Activation”. The main subjects to be tackled are as follows:

- 1) To commence research and development activities focusing on analyzing the optimal and suitable farm management practices for the region
- 2) To study the ‘Integrated Water Resources Management in the Gorgan Plain’
- 3) To study the ‘Mazandaran Water Supply Project’ to convey surplus water from Mazandaran Province to Gorgan Province
- 4) To clarify available resources to be mobilized and
- 5) to strengthen the coordination activities among relevant agencies

The activities during this phase are to be focused on the improvements of the existing irrigation and drainage schemes, and not on the expansion of irrigated area because of insufficient water resources.

(4) Phase-2 from 2010 to 2014 5 years

Phase 2 is to be titled as ‘Improving the Present Agriculture and Preparation for Wider Development’. The results of the research and development activities during the previous phase should be continued further for the examination on new subjects. The facilities to be proposed in the ‘Integrated Water Resources Management in the Gorgan Plain’ shall be implemented to facilitate sufficient water availability for the plain. Construction of facilities shall also be started, if the study on ‘Mazandaran Water Supply Project’ is concluded to be feasible.

Fig. A8.1.1 Scenario of Agricultural Development in Gorgan Plain

Phase & Duration	Phase 1 : 2005 ~ 2009 (5 Years)	Phase 2 : 2010 ~ 2014 (5 Years)	Phase 3 : 2015 ~ 2019 (5 Years)	
Tasks of Phase	Preparation for Sustainable Agricultural Development & Rural Activation	Improving present agriculture & Preparation for wider development	Implementing Sustainable Wider Range Agricultural Development	
Development Frame	<ul style="list-style-type: none"> <li>* To promote information sharing among stakeholders</li> <li>* To enhance effective water use technology &amp; make concrete regulations</li> <li>* To enhance improvement within existing resources &amp; infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>* To secure available water capacity through rational operation of dams</li> <li>* To improve production infrastructure for water saving agriculture</li> <li>* To commence preparation works for Mazandaran Water Supply Project.</li> </ul>	<ul style="list-style-type: none"> <li>* To promote middle &amp; large scale sustainable agriculture &amp; integrated green house farming.</li> </ul>	
Approaches for Agricultural Development	Project Management	* To set up "Golestan : Planning Phased development on clear task allocation Agriculture Board"	* M&E on whole activities related with agriculture development to meet with harmonized resources mobilization in the region.	
	Water Resources	<ul style="list-style-type: none"> <li>To set measures within present water resources capabilities.</li> <li>* To construct Farm Pond(s) by each Irrigation Scheme to save river water in wet season.</li> </ul>	<ul style="list-style-type: none"> <li>To set measures under all dam completion &amp; their available water by operation.</li> <li>* To provide Farm Pond(s) for Dry Land Farming Area</li> <li>* To supply water to dry land farm ponds through inter-regional water conveyance system.</li> <li>* To secure sufficient water to leach salt and sodium.</li> </ul>	
	Soil Resources	<ul style="list-style-type: none"> <li>* To provide drainage networks for inundation potential areas</li> <li>* To Study / Test efficiency &amp; feasibility of "Pipe Drain " &amp; " Mole Drain"</li> <li>* To distinguish irrigation available areas and others with surface water.</li> <li>* To conduct soil monitoring</li> <li>* To conduct R&amp;D of soil improvement under crop &amp; husbandry integration practice.</li> </ul>	<ul style="list-style-type: none"> <li>* To introduce proper agriculture program to enhance fertility.</li> <li>* To provide permanent drain sys to realize sufficient leaching</li> <li>* To conduct monitoring under R&amp;D of sub-surface drainage.</li> <li>* To establish continuous soil monitoring organization</li> <li>* To extent soil improvement practice under a proper agriculture program.</li> </ul>	
	Irrigation & Drainage	<ul style="list-style-type: none"> <li>* To provide drainage networks for inundation potential areas</li> <li>* To provide economical mole drains to control groundwater level.</li> <li>* To distinguish irrigation available areas and others with surface water.</li> <li>* To conduct R&amp;D to confirm effects on drainage system ( Open &amp; sub-surface )</li> <li>* To construct desiltation pond by each existing irrigation scheme.</li> <li>* To provide &amp; exhibit trial &amp; extension farm.</li> <li>* To promote water saving irrigation practices in the basins</li> <li>* To Study / Test water saving type irrigation practice at Demonstration Farm (D.F)</li> </ul>	<ul style="list-style-type: none"> <li>* Implement pipe drain sys. extension projects (existing schemes )</li> <li>* To provide economical mole drains to control groundwater level.</li> <li>* To distinguish irrigation available areas and others with surface water.</li> <li>* Implement mole drain sys. extension projects (Dry land )</li> <li>* To promote water saving irrigation practices in the basins</li> </ul>	
	Farmers' organization	<ul style="list-style-type: none"> <li>* Train on Participatory Learning &amp; Action for Deh Council &amp; Cooperative.</li> <li>* Strengthen cooperative function &amp; take-off from Govt supports to self-management</li> <li>* Extension on group farming management &amp; new technologies.</li> </ul>	<ul style="list-style-type: none"> <li>* To Accelerate promotion of rural production cooperatives.</li> </ul>	
	Extension	* Provide & implement "Demonstration Farm (D.F)"	* To strengthen agricultural & livestock extension services.	* To strengthen agricultural & livestock extension services.
	Agricultural Management	<ul style="list-style-type: none"> <li>* To improve present agricultural management at field level.</li> <li>* To introduce agri - program harmonized with livestock, pasture land farming and dry farming</li> <li>* Implement study/trial to integrate administration and R&amp;D activities.</li> <li>1) Enhance salt leaching &amp; crop production by under drain sys. in irri-land.</li> <li>2) Soil &amp; crop production improvement at dry lands</li> <li>3) Improve soil fertility with introduction of pasture plants to crop rotation.</li> <li>4) Plastic greenhouse farming trials</li> <li>5) Windbreak tree trial planting and their M&amp;E</li> <li>6) Food processing (Aiming at exporting of grain, dairy products, olive, etc)</li> </ul>	<ul style="list-style-type: none"> <li>* Extend crop &amp; husbandry combined farming practice.</li> <li>* Increasing of productivities of crops &amp; fruit trees</li> <li>* Enhancement of Sustainable farming practice</li> <li>* Promotion of plastic greenhouse</li> <li>* Promotion of food processing</li> <li>* Promotion of mechanization system</li> </ul>	* To enhance establishment of aspects proposed in the left column.
	Marketing	* To maintain present improvement approaches.	* Enhance value added production.	* Enhance value added production.
	Assisting Fund	<ul style="list-style-type: none"> <li>* To conduct clarification survey on farmers' debts and solution alternatives.</li> <li>* To maintain present improvement approaches.</li> </ul>	<ul style="list-style-type: none"> <li>* Conduct Govt assistances aiming to choose proper farm size to survive.</li> <li>* To conduct debt relief assistances to farmers</li> </ul>	<ul style="list-style-type: none"> <li>* Set assistance entrepreneur type farming to meet with national food security policy.</li> <li>* To conduct debt relief assistances to farmers</li> </ul>
	External Conditions	Project Management &	<ul style="list-style-type: none"> <li>* To Establish integrated regional development sys. "Golestan Development Board (GDB)*"</li> <li>* To commence R&amp;D to realize sustainable agriculture available to increase income.</li> <li>* To examine &amp; implement promotion programs to exalt farmers' willingness</li> <li>* Both Central &amp; Provincial Govts have to have clear regional plan for future.</li> <li>* To promote programs to avoid traditional land division customs, to keep sufficient farm size.</li> </ul>	<ul style="list-style-type: none"> <li>* Set policy to distinguish &amp; choose proper farm size through land integration.</li> <li>* To examine &amp; implement promotion programs to exalt farmers' willingness</li> <li>* To establish the government assistance programs to realize stable crop selling</li> <li>* To introduce proper scale farming available to survive with sufficient income</li> <li>* To rationalize &amp; qualify administrative services to decrease farmers' distrust</li> <li>* To promote programs to avoid traditional land division customs, to keep sufficient farm size.</li> </ul>
Water Resources & Basin Management		<ul style="list-style-type: none"> <li>* To examine optimal dam operation rule to expand usable water</li> <li>* To conduct river bed stabilization to secure sufficient intake from river</li> <li>* To study regional hydrological circulation and optimal water allocation among sectors</li> <li>* To study needs and availability of inter-provincial water supply project, actually from Maza</li> </ul>	<ul style="list-style-type: none"> <li>* To examine optimal dam operation rule to expand usable water</li> <li>* To construct internal water supply system to convey surplus water from piedmont areas.</li> <li>* To enhance watershed management in upstreams including reforestation.</li> <li>* To conduct river bed stabilization to secure sufficient intake from river</li> <li>* To study regional hydrological circulation and optimal water allocation among sectors</li> <li>* To complete constructions of all dams both under plans and construction.</li> <li>* Commence "Mazandaran Water Supply Project" construction.</li> </ul>	
Market, Others		<ul style="list-style-type: none"> <li>* Demand Grain Same as present</li> <li>* Demand Vegetable Same as present</li> </ul>	<ul style="list-style-type: none"> <li>* Demand ; Increase market demand and crop diversification by urbanization.</li> <li>* Market ; Increase contract cultivation by activation of regional economy.</li> </ul>	
Donors		<ul style="list-style-type: none"> <li>* JICA PTTC Scheme Reg. to integrate administration &amp; R&amp;D activities.</li> <li>* Foreign Assistances &gt; Extension on verified trial results for SODOSW, SHCWC, SMWSP</li> </ul>	<ul style="list-style-type: none"> <li>* Loan from International Agencies for Mazandaran Water Supply Project</li> </ul>	

(5) Phase-3 from 2015 to 2019 (5 years)

This phase is to be captioned as ‘Implementing Sustainable and Wider Range of Agricultural Development’. The results of research and development activities should be extended in the region. Enough quantity of water shall be conveyed through ‘Mazandaran Water Supply Project’, which shall be commenced and the water will be utilized for further agricultural development of the region, as per intentions of the Iranian Government. Scenario of Agricultural Development Planning in the Gorgan Plain is summarized as shown in Table A8.1.1.

As stated in the scenario of agricultural development, it is highly important to secure stable and sufficient water resources to realize sustainable agricultural development in the Gorgan Plain. Besides, watershed conservation is also necessary to prevent the sedimentation and flooding problems in the Gorgan plain. Therefore the Study on ‘Integrated Water Resources Development and Watershed Conservation in the Gorgan Plain’ shall be carried out to clarify availability of usable water resources and the watershed conservation measures necessary for the area. A brief description of the Study is given below.

### **A8.1.3 Study on Integrated Water Resources Development and Watershed Conservation**

(1) Necessity of the Study

A study of the water resources in the area was carried out in 1972. But the conditions of the water resources utilization have been changed due to several changes in the basin, such as the construction of actual dams. Hence, it is necessary to revise the water use condition to permit an efficient and optimal utilization of water resource. Cutting of the trees in the upstream areas have also created significant impact in the watershed during the past 30 years. It is necessary to propose suitable watershed conservation measures for the area.

(2) Effects of the Study

The study shall recognize the exact water circulation in the whole area, while evaluating the effective water distribution. It will allow an efficient water use and watershed conservation in future for the regional development, based on the availability of water resources. It will also recognize the water availability in both the watersheds, creating the basic conditions to succeed projects such as ‘Water Supply from the Mazandaran Province’.

(3) Contents of the Study

The Study mentioned here shall be realized for the watersheds of Gorgan and Gharasu rivers, clarifying the actual water use condition and water demand in the area. The usable water resources shall be studied, pointing out the water shortage by area in the watershed.



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

The same thing can be said to the dam operation structure. The data (including the dam's storage condition) should be available for the involved institutions in and out of the province to permit an effective water use. The instantaneous availability of information such as water shortage and surplus will permit an efficient water use in the basin. The water supply from the Mazandaran Province to the Gorgan Plain will also require an efficient communication system. Hence, the present system shall be improved to permit a more flexible decision to manage the water use according to each condition.

The improvement plan shall include the following aspects, but the detailed evaluation shall be carried out in the study.

First the Gorgan plain can be divided into 2 watersheds: Gorgan and Gharasu. All dams will be connected to the Golestan Central Office. Each dam will be connected to the dams in the same watershed to permit the communication between them. The climatological and hydrological stations will be linked to the dams to make possible the prediction of the dam operation. Also all irrigation schemes shall be linked to the responsible dam. The Golestan Central Office shall be linked to the Mazandaran Central Office to permit an efficient management of the water supply between both provinces in the future.

The final form of this system shall be an on a line network. The possibility to share detailed information will make it possible to control the water use considering the general conditions of the watersheds, allowing an efficient water use. So, the hard component is very important, but the soft component must also be sufficiently considered to improve the possibility of succeeding the results of the development project.

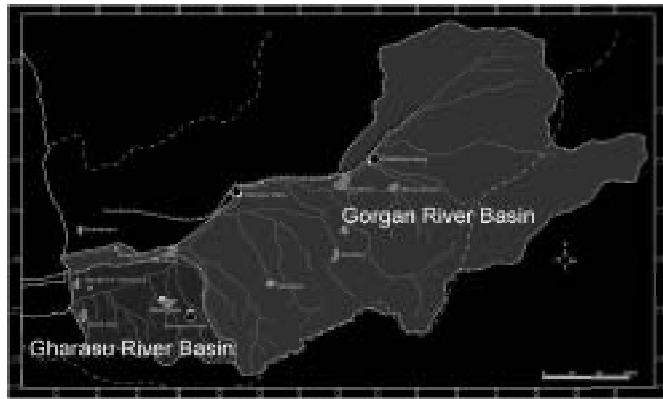
Considering the above aspects, the Terms of Reference (TOR) for the Proposed Study is prepared as mentioned below.

#### (4) Objectives of the Study

- 1) To analyze the existing conditions of the Gorgan and Gharasu river watersheds including water resources potential, existing problems of the watersheds, watershed conservation measures, estimating the present and future water demand and realizing water balance in the Gorgan Plain;
- 2) To formulate a well-balanced integrated water resources and watershed conservation, including inter-basin and inner-basin water transfer, considering natural and social environment in each river watershed as well as in the neighboring watersheds.

(5) Study Area

The Study Area covers the watersheds of the Gorgan river (11,480 km<sup>2</sup>) and Gharasu rivers (1,720 km<sup>2</sup>).



(6) Phases of the Study

The Study shall be divided into two phases.

Phase I: Evaluation of the Existing Water Resources Development and Watershed Conservation

Phase II: Elaboration of the Integrated Water Resources Development and Watershed Conservation Plan

Phase II-1: Alternative Study for the Integrated Water Resources Development and Watershed Conservation Plan

Phase II-2: Formulation of the Integrated Water Resources Development and Watershed Conservation Plan

(7) Study Schedule

The total period for the Study will be 14 months. The period for each phase is as follows:

Phase I: 6 months

Phase II: 8 months (Phase II-1: 4 months and Phase II-2: 4 months)

Study Schedule

Phase	Phase I: Evaluation of the Present Water Resources						Phase II: Master Plan Study							
							Alternative Study				M/P Formulation			
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Schedule														

(8) Expertise Required

- 1) Team Leader (Regional Development Planner)
- 2) Water Resources Management Engineer
- 3) Hydrologist (Including Modeling)
- 4) Hydrogeologist

- 5) Irrigation/Drainage Engineer
- 6) Agronomist
- 7) Environmental Management Engineer
- 8) Water Supply Engineer (Including Water Quality)
- 9) Institutional and Organization Planner
- 10) Socio-economist and Financial Planner
- 11) GIS Specialist

(9) Implementing Agency

The Ministry of Energy and Water Resources shall be the implementing agency and also acts as the coordinating organism in relation with other government and non-government organization for the smooth and appropriate implementation of the Study.

## **A8.2 Selection of Priority Area for the Feasibility Study**

At the first step of the scenario of agriculture development, it is necessary to select a priority area, which can be developed as a 'sustainable development model' for the future Gorgan plain agriculture development and to provide a 'success story' to the farmers in the vicinities for the future development of the region. With this purpose, a priority area was selected as mentioned below.

### **A8.2.1 General**

(1) Role of the Study

The main task of this Study is to examine the most appropriate measures to develop the agriculture in the Gorgan Plain, based on the results of the present conditions. Especially, agriculture in the northern part of the Study Area presents many expectations such as improvement of staple food production by the effective utilization of the wide area of the plain, expedition on settlement of the people who have strong nomadic culture, generation of employment opportunity, etc.

It can be said that the selection of the development priority areas has to be the first step to provide a success story for the farmers in the vicinities to refer for future development.

(2) Meaning of Selection of the Priority Area

There are four development districts in the Study area, which consist on five irrigation schemes, mainly supported by the Government, and one district which has been developed from the ancient time. Also, different sources of irrigation are utilized, such as groundwater and river water. Usually farmers are managing both irrigated area and dry farming according to the circumstances.

Nomination of potential area is to select proper precedent schemes, which are to be adopted in the further feasibility examination, basing on the results of the inventory survey.

### **A8.2.2 Selection of Priority Area**

#### **(1) Pre-requisites for the Selection of Priority Area**

It has been recognized commonly among the stakeholders that both of quality and quantity of water must be secured to realize the agricultural development in future, desired by the Government. The lack of water will increase the problems due to salt accumulation in the future. The nomination of the development potential areas in this study stage will be done under a pre-requisite that a phased development approach is to be adopted within the present limited resources.

#### **(2) Criteria of Selection of Priority Area**

The definition of the “Priority Area Selection” can be done in two ways: one is to nominate certain area(s) directed for the improvement from present conditions and the other is for areas with difficulties to keep the present production and need development to change the actual situation. The criteria for the area selection will be set as follows based on the above understanding.

##### **1) Farmers’ Organization, Participation Intention and others.**

It is well known commonly that stakeholders’ “sense of ownership” is the most important factor to sway results of any projects and activities. Any project has different problems and constraints.

The organization of the farmers, cooperative activation, sense of ownership and participating conditions of the farmers can be listed as reference indicators of farmers’ willingness. Those information is not numerical statistical data, excluding the organization of the farmers. Those non-numerical data are entirely subjective, just impression obtained by the Study Team through field surveys.

##### **2) Sufficiency of Present I & D Facility**

There are six irrigation and drainage schemes in the Study Area. All the schemes have never reached to the completed conditions as planned originally. The main cause of those under-development is “Scarcity of the National Budget” for project implementation. There is no assurance to define the project completion year. Besides, farmers’ financial capability to has been getting worse due to propelling the social movements and policies of ‘Cost Sharing Concept’.

Both of comparative sufficiency of present I & D facility and assurance of proper conditions

for crop cultivation are necessary to secure the results of improvement. Hence ‘Sufficiency of the Present I & D Facility’ is to be set as one of criteria for the selection.

### 3) Salinization of Irrigation Water Source

All of irrigation schemes in the study areas are depending on Gorgan River as water source. The water quality, during the dry season, becomes worse in the downstream direction due to the drainage water from farm lands along the river. Hence, ‘Salinization of Irrigation Water Source’ at the intake point is to be referenced as one of criteria for selecting the site(s).

### 4) Availability of Irrigation Water

The flow of Gorgan river in dry season comes only from the “Environmental Conservation Maintenance Flow”, discharged from the Voshmgir Dam after the completion of the Golestan Dam construction in 2001. So, the available river water gets smaller in the downstream direction.

So, the project success will depend on the water availability at the intake point along the river, which will be one of the reference item for the selection criteria.

### 5) Actual Irrigable Area

All of the existing irrigation schemes have pump station. But they are not supplying 100% of the irrigation requirement. It is planed in the future the construction of farm ponds to store enough water, capable to satisfy the total irrigation requirement.

The coverage rate of the actual irrigated area can be one reference to indicate how many farmers are benefited by the present irrigation facility. If the irrigation system is not sufficient, naturally the farmers are going to find out other alternatives to secure their crop yield or to obtain a rational benefit/cost, decreasing their intention to participate in cooperative activities. So, the ‘Actual Irrigable Area’ will be one of the selection criteria.

### 6) Affinity of the farming conditions to vicinities

The Government expects to propel staple food production, mainly wheat production, through utilizing the wide area of the Gorgan Plain. Sufficient water for irrigation on both quality and quantity is indispensable to avoid salt hazard and to secure sufficient crop yield to meet with the Government intentions, while solving many constraints to reach to the target.

The affinity of farming condition is to be one of references to nominate the site, to apply the results of activities to solve constraints to the vicinities.

### 7) Accomplishment of drainage activities

It is known widely that salt accumulation in the soil deeper layers is found at major part of the

Study Area because it was included in the inundation area of the ancient Caspian Sea. Also, the high groundwater table condition and low permeability situation is recognized as a result of “loess” deposit. Golestan J.A.O has poured efforts to improve such soil conditions by providing open channel drainage networks as preparatory works before introducing irrigation practices in the Area.

It is known, through their experiences, that it takes several years to decrease the water table and leach out the salts in the soil with only natural rainfalls, by the open drainage system. According to this, the accomplishment of preparatory drainage activities will be one of the criteria to select the site(s).

### (3) Selection of Development Potential Area

The selection of the target areas for the feasibility study was carried among the five existing irrigation schemes. The selection of the development potential areas was made based on the nomination criteria presented in the previous section.

The right side table shows the results of the selection comparing each scheme according to each criteria. The numbers are not from any numerical information, but just show the result of comparison obtained through the field survey.

It was found that the Tazeh-Abad Scheme is the most potential area, followed by the Hemmat, Mehtar Kalateh and Gomishan Scheme. The Gomishan-Kesht and Shadi-Mehr Scheme did not have not sufficient time to show concrete results of the open drainage effects after their provision. It seems that few more years will be necessary for the crop cultivation without high salinization problems. The Gomishan Scheme seems to have relatively higher risk potential than the others, in relation to the stable production and farm income, if continuing the present farming practice, due to the scarcity of usable water and high salinization problems.

Hence, Tazeh-Abad Scheme was selected as the area that represents the present farming conditions in the region and will be utilized for the studies in the feasibility study stage.

Comparision Nominated Development Potential Areas

Descriptions	No.1	No.2	No.3	No.4	No.5	No.6
	Tazeh-Abad	Hemmat (Aghghabar)	Shadi Mehr (Aghghabar)	Gomishan (Banaver)	Gomishan Kesht	Cheldin (Mehtar Kola)
Cooperative entry accomplishment	6	5	1	3	2	4
Cooperative activation	6	5	1	4	2	3
Sense of ownership, participating conditions of farmers	6	5	1	4	2	3
Sufficiency of Present Irrigation. & Drainage Facility	6	6	1	3	2	6
Salinization of irrigation water source	5	4	4	2	2	6
Availability of irrigation water source	5	4	4	2	2	6
Actual irrigable rate on extent	5	4	2	3	2	6
Affinity of the farming conditions to vicinities	6	6	6	6	6	1
Accomplishment of drainage activities	5	5	2	3	2	0
Total	50	44	22	30	22	35

Note ; 1). Bigger number is superior comparatively.  
2). Numbers are only impressive puriority only.

### **A8.2.3 Selection of the Case Study Area**

#### **(1) Arguments of the Iranian Side**

While expressing approvals for the site selection, Golestan J.A.O requested further consideration to select also the Cheldin Irrigation Area. The Iranian side arguments are as follows.

- a. Cheldin area shares a part of piedmont agricultural area, which is considered as the main agriculture production area in Gorgan Region

While the greatest intentions of the Iranian Government is on the agricultural development of Gorgan Plain, which has been left out of the major development activities, it is known that the piedmont region has contributed for a major part of the agricultural production of in the region since old days. It was explained that the reason to have added this area as a part of the Study Area came from such understanding, while signing the Scope of Works of the Study.

- b. Necessity of effective example to show the farmers the way to improve the present conditions independently

Golestan J.A.O understood that the major constraints in the Cheldin Area are related to the management aspects, such as land reform to enhance more rational agricultural practices, utilize private wells as common water sources to solve unbalanced water allotments, land donation to provide public drainage system against seasonal inundation. A case study in the Cheldin Area will facilitate to show farmers the way to improve the present conditions independently.

#### **(2) Recognition for Cheldin Irrigation Area**

The following aspects were recognized in the Cheldin Irrigation area in the initial site selection.

- a. Cheldin Area does not represent the farming condition in the Gorgan Plain

The stronger intension and expectation of agricultural development, under a very severe natural condition of the Gorgan Plain is included in the background of the given subject of the Study, instead of the improvement of agriculture in the piedmont zones, where the conditions are more stable and milder. It can be said that Cheldin Area does not represent the farming condition of the Gorgan Plain.

- b. Maturity and problems of the Cheldin Area

The agriculture in Cheldin Area is relatively plentiful with less problems of salinization and well diverted products with relative enough irrigation water and fertile soil, different to the plain area. The problems and constraints raised by the farmers were mainly directed to the

management aspects and less to the engineering one. Aspects like land reform to enhance more rational agricultural practices, utilization of private wells as common water sources to solve the unbalanced water allotments, land donation to provide public drainage system against seasonal inundation, are not handled well through the Government's interventions. It seems better to wait for the growth of farmers' self-reliance to co-work against those constraints.

c. Necessity on improvement of agriculture in Cheldin Area is relatively lower.

The farmers in the Cheldin Area utilize water from the mountain torrents and groundwater for irrigation. Comparing the agriculture of Gorgan Plain, the development is well-balanced with high productivities and a high crop variation. The necessity to improve the Cheldin Area agriculture is relatively lower than the Gorgan plain.

(3) Proposed 'Case Study Area'

Golestan J.A.O expressed their intention to select a case study area as an example of improvement in Cheldin Area, even though not adapting for a feasibility study.

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

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

### **A8.3 Agricultural Development Plan of Tazeh Abad Project Area**

#### **A8.3.1 Outline of the Development Plan**

(1) Considerations for the Agriculture Development Plan

1) Considerations

The following aspects are considered for the agriculture development plan.

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

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

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

Most of the farmers are already under burden of debt under the 'cost sharing policy', and



therefore, the planning should be made such that the cost allocation by the farmers will be low, by considering an effective and low cost project plan.

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

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

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

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

## 2) Placement of This Plan

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

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

## (2) Components of Agriculture Development Plan

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

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

Each of the plans is described below in detail.

### **A8.3.2 Farming Plan**

#### **(1) Proposed Farming and Cropping System**

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

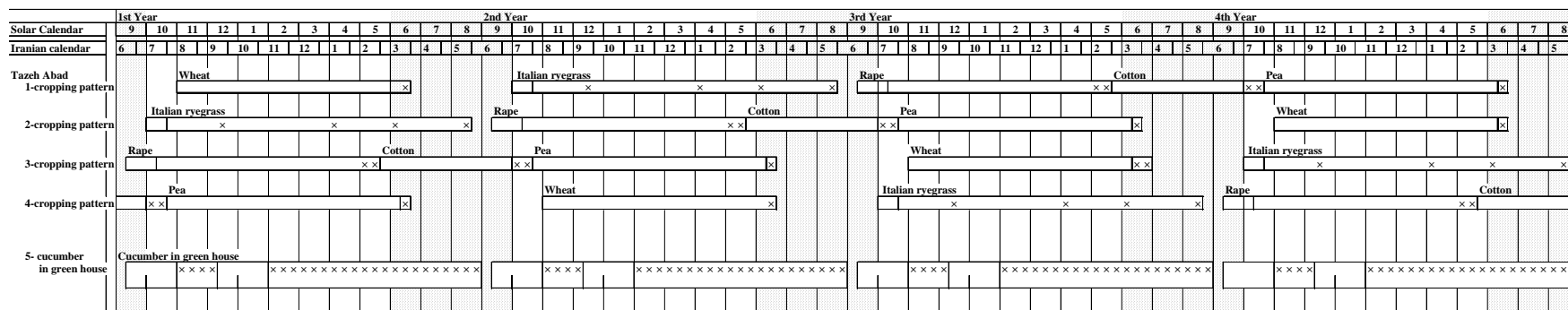
To execute the proposed plan, there are some requisites, such as supply of required irrigation water, drainage for decrease of salinity in soil in order to cultivate the crops, which have poor resistance to salt, such as pea, maize, etc. It might take several years to remove salt after accomplishment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

The proposed cropping system is one of the models of crop rotation. Various changes can be made in the model by change of crops with process of desalinization or with farming scales. Especially, the small-scale farmers could not help introducing vegetables in exchange for cotton and pea in order to increase the profits. Besides, all the farmers could introduce tomatoes for processing in change for cotton under contract between RPC and processing factories.

The proposed rotation is as follows:

- 1 ) Four-year rotation is adopted, because the number of main crops in winter is four (Fig. A8.3.1).
- 2 ) Five (5) crops included in the rotation, such as wheat, annual grass (e.g. Italian ryegrass), rape, cotton and pea. The growth periods of various crops are shown in Table A8.3.1 and Fig. A8.3.2. Crop rotation is made by the combination of these growth periods of crops. Besides, the plan is considered carefully on shortage of irrigation water in July.
- 3 ) The cropping pattern is “wheat – annual grass – rape – cotton – pea”.
- 4 ) In the plan, a farmer divides his own field into four plots and cultivates four cropping patterns every year as shown in Fig. A8.3.1. Therefore, the farmer shall produce 5 crops every year to keep balance of agricultural income every year

Fig. A8.3.1 Growth Period and Rotation of Crops (Plan for Tazeh-abad)



- Note
- 1) Sowing - Transplanting - Irrigation x - Harvesting
  - 2)  Dry season
  - 3) In the both survey area, the four-year crop rotation is adopted. The composed crops in the rotation are wheat, rape, grasses (Italian ryegrass), pulse crops (pea) as winter crops, and cotton, as summer crops.
  - 4) Livestock farming, which each farmer raises mother cows of 10 heads, is carried out by each farmer besides above mentioned farming.
  - 5) In small scale farm households, a cucumber cultivation throughout the year in a greenhouse is introduced.

### Water Demand

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

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

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

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

- Note :
- a. Assumed irrigation method for the above estimation is "Basin Method" for farm field with 0.43 efficiency.
  - b. Besides that irrigation efficiency for the green house is 90% for the calculation.
  - c. River discharge from the mid June to the mid Sep is assumed not available for intake due to the quality.

Fig. A8.3.2 Growth Period of Crops

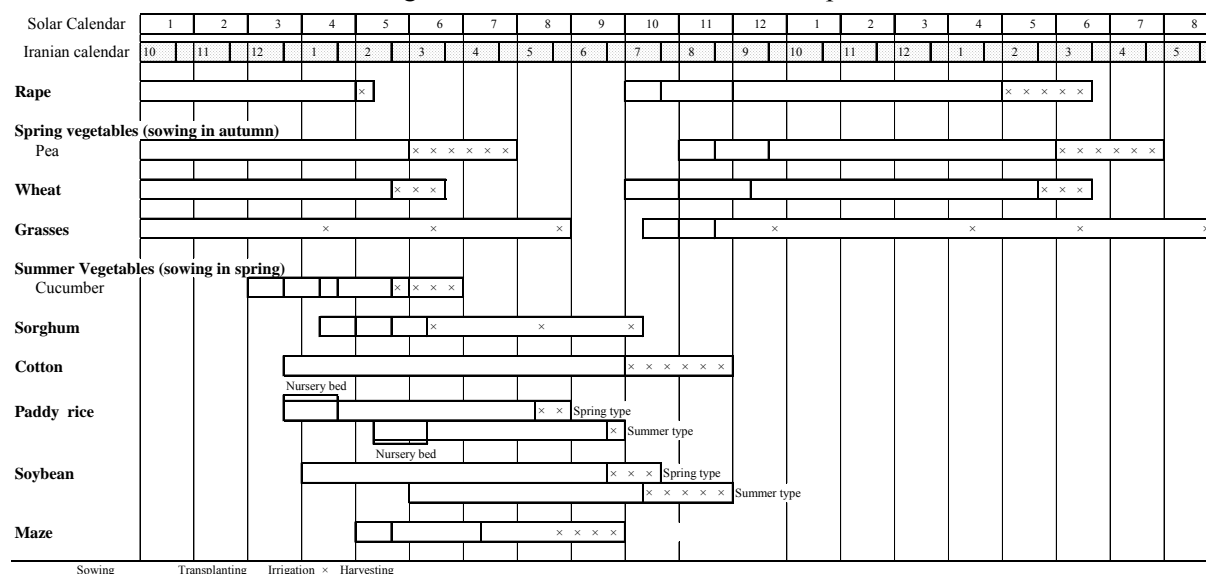


Table A8.3.1 Growth Periods of Crops

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

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

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

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

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

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

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

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

7) When the farmer cultivates each cropping pattern in every one ha, the annual profits by cultivation of five crops will be as shown in Table A8.3.2.

Table A8.3.2 Annual Profits by Crops in Tazeh Abad

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

Note: 1) Average yields of cotton, wheat and rape are used. Yields of grass and pea are the estimated figures.  
 2) Average costs in Golestan Province and unit prices of crops, except grass, are used.  
 3) Cost and unit price of grass are estimated in Table A8.3.8.

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

## (2) Animal Husbandry

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

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

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

The plan is shown in Table A8.3.3 in detail. Outline of the plan is as follows;

- 1) Buildings: mother cow stall of 40m<sup>2</sup>, 3 stalls for young cattle and calves of 28 m<sup>2</sup> in total, storage room of 12 m<sup>2</sup>, and paddock of 80 m<sup>2</sup>. Cost is about 19 million Rls.
- 2) Facilities: milker, milk storage tank, etc. Cost is about 7.35 million Rls.
- 3) Purchase cost of cows of 10 heads is 55 million Rls. Investment costs (1), 2), and 3)) is about 82 million Rls. in total.
- 4) Annual running cost is about 23 million Rls.
- 5) Annual gross income is 27 million Rls. by sale of milk, 10 million Rls., by sale of bull, 12 million Rls., by sale of young cow, etc., about 49 million Rls. in total.

Table A8.3.3 Plan of Hybrid Cow (Hybrid Local Cow with Holstein) Farming of 10 Heads

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

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

- 6) Annual net income is about 24.5 million Rls.
- 7) Repayment of loan during 5 years is about 21 million Rls.
- 8) Therefore, the net income during 5 years of repayment of loan is about 3.6 million Rls. After 5 years from commencement of the plan, the net income will become about 24.5 million Rls.

(3) Economy of the integrated farming plan

Annual profits in the integrated farming of agriculture of 4 ha and animal husbandry raising of hybrid cows of 10 heads are shown in Table A8.3.4. In this case, the average in Aq Qala is used as yields of cotton, wheat and rape. Yields of grass and pea are the estimated figures. Besides, the average in Golestan Province is used as costs and unit prices of crops, except grass. The net incomes are composed of 1.6 million Rls. of wheat, 3.1 million Rls. of rape, 1.9 million Rls. of grass, 0.5 million Rls. of pea, 1.9 million Rls. of cotton, and 24.5 million Rls. of stock farming, 33.6 million Rls. in total. However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, Annual profits of the integrated farming become about 13 million Rls.

On the other hand, in case of the same integrated farming with high level of technology, the net incomes are composed of 3.1 million Rls. of wheat, 3.9 million Rls. of rape, 1.9 million Rls. of grass, 1.0 million Rls. of pea, 0.8 million Rls. of cotton, and 24.5 million Rls. of stock farming, 35 million Rls. in total (Table A8.3.5).

Table A8.3.4 Annual Profits of Farm household in Farming of 4 ha in Tazeh Abad (Average Plan)  
(5 crops cultivation under irrigation in 4-years rotation and raising of hybrid local cows of 10 heads)

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

Note:

- 1) Yields of cotton, wheat and rape are used the average in Aq Qala. Yields of grass and pea are the estimated figures.
- 2) Costs and unit prices of crops, except grass, are used the average in Golestan Province.
- 3) Cost and unit price of grass are estimated in Table A8.3.8.
- 4) Gross income , production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table A8.3.3).

Table A8.3.5 Annual Profits of Farm household in Farming of 4 ha in Tazeh Abad (High Level Plan)

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

Note :

- 1) With regard to yields, the highest yield of cotton, wheat, and rape were used in Tazeh-abad at present. Data of yield of grass and pea are the estimated figures.
- 2) Wheat, cotton, rape and pea: Data were examined about each component of production costs. The average (2000-2001) in Golestan Province was generally used. Besides, the necessary fertilizer, such as potassium, sulfur, micro-elements, etc., irrigation water charge in Peivand RPC and repayment of debts to RPC were added with actual cost (Table A8.3.6, A8.3.7).
- 3) On annual grasses, there is no data on production costs in detail. Therefore, cost of each component of production costs were made with reference to that of wheat and cotton. 4 tons of hay was estimated as total yield per ha of 3 times harvesting (Table A8.3.8).
- 4) Gross income, production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table A8.3.3).



However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, Annual profits of the integrated farming become about 16.5 million Rls.. In this case, with regard to yields, the highest yield of cotton, wheat, and rape in Tazeh Abad at present are used as yields in the Table. Yields are 4 tons per ha of wheat, 2.5 tons per ha of rape, 4 tons per ha of grass, 1.5 tons per ha of pea, and 2 tons per ha of cotton, respectively. Data of yield of grass and pea are the estimated figures. Data of production costs of wheat, cotton, grass, rape and pea were examined about each component of production costs. The average (2000 ~ 2001) in Golestan Province was generally used. Besides, the necessary fertilizer, such as potassium, sulfur, micro-elements, etc., irrigation charge in Peivand RPC and repayment of debts to RPC were added with actual costs (Table A8.3.6 and A8.3.7). On annual grass, each component of production costs is made with reference to that of wheat and cotton (Table A8.3.8).

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

#### (4) Cultivation System

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

- Strict enforcement of pre-irrigation

- Fertilization of sulfur, micro-elements

- Organization of land use, mechanization in small scale farming and of irrigation, and conscientiously keeping of the rule in the organization

- Participation to the training courses of RPC and the Extension Service Center

- Strict enforcement of crop rotation

- Increase of soil organic matter and soil fertility by annual grass cultivation

- Trials of cultivation technologies on different crops, method of drainage in fields etc..

#### (5) Mechanization for Grass Cultivation

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

Annual grass of first harvest in December is used to own livestock as green fodder, because it is rainy in winter and difficult to make hay. Grass of harvest in April to August is used as hay. In hay-making of grass, it takes 3 days to work of cutting of grass, raking for drying in the sun, collecting dried grass to the raw, baling to hay and transport to storehouse. The required machinery is shown in Table A8.3.9.

Table A8.3.6 Cultivation Method and Production Cost (wheat under irrigation, for Tazeh Abad)

<b>Farm Materials</b>					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Sterilizing seeds	kg	180	11,300	203,400	1st; 80,000 Rls./ha, 2nd: 70,000 Rls./ha, 3rd; 50,000 Rls. Sevine Topic, grand Star debt; construction of canal and drains. Allotting amount to 2 crops during a year.
Fertilizer (phosphate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potasium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	times	4	62,500	250,000	
Pesticide	kg	2	14,000	28,000	
Herbicide	liter & kg	1 lit. + 15 g	79,400	79,400	
Insurance due				8,000	
Repayment of debts	ha	1	102,000	51,000	
<b>Farm Works</b>					
Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (drill)		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		2	15,000	30,000	
Irrigation water charge		2	30,000	60,000	
Spraying pesticide		2	25,000	50,000	
Harvesting (with combine)		1	200,000	200,000	
Transporting products to market				35,000	
Total cost				1,470,300	
Income by sale of straw				360,000	200packs, each 1,800 Rls
Net production cost				1,110,300	

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

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

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

Table A8.3.7 Cultivation Method and Production Cost (Cotton under irrigation, for Tazeh Abad)

<b>Farm Materials</b>					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seed	kg	40	2050	82,000	
Fertilizer (phosphate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	150	315	47,250	
Fertilizer (Potassium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	times	3	110,000	330,000	1st; 130,000 Rls./ha, 2nd: 100,000 Rls./ha, 3rd; 100,000 Rls.
Pesticide	kg	12	20,000	240,000	
Herbicide	liter	2.5		28,500	Sonalan
Insurance due				14,000	
Repayment of debts	ha	0.5	102,000	51,000	debt; construction of canal and drains. Allotting amount to 2 crops during a year.
<b>Farm Works</b>					
Items	Unit	Number of times	Unit price Rls	Cost Rls/ha	Remarks
Plowing	ha	1.5	75,000	112,500	
Disc harrow	ha	4	37,500	150,000	
Sowing (drill)	ha	1	40,000	40,000	
Making drain	ha	1	30,000	30,000	
Pesticide	ha	1	30,000	30,000	
Transporting seeds and fertilizer	ha	1	12,000	12,000	
Fertilization	ha	2	15,000	30,000	
Weeding	ha		-	559,000	Manual (33 persons x 13,000
Cultivator	ha			25,000	Rls), car (8,000 Rls)
Spraying pesticide	ha	4	30,000	120,000	and oversee worker (50,000 Rls)
Irrigation		4	30,000	240,000	Manual (4 times x 2 persons)
Harvesting (with combine)	ha			945,000	Manual (labor 57 x 15,000 Rls,
Transporting products to market	kg	2,200	40	88,000	oversee worker 3 x 25,000 Rls, car
Other cost				295,400	8,000 Rls
Profit of fund				271,380	
profit of management				647,353	
Other cost				295,400	
Total cost				4,870,258	

Note :

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

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

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

Table A8.3.8 Cultivation Method and Production Cost (Annual Grass under Irrigation/for Tazeh Abad)

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

When total hay yield is 4/ha, and producer's price is 825 Rls/kg, the gross income is 3,300,000 Rls. The net income is 1,935,500 Rls/ha.

The gross income, production cost and the net income per kg are 825 Rls/kg, 341 Rls/kg and 484 Rls/kg, respectively.

The net income is about 59 % of the gross income, and about 142 % of the production cost.

Table A8.3.9 Machinery for Cultivation of Pasture Plants (2002)

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

Source: Golestan Jihad-e-Agriculture Organization

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

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

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

#### (6) Plastic green house

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

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

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

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

Outline of the plan is as follows;

- 1) According to the plan, four houses of 500 m<sup>2</sup> each are constructed and managed to decrease costs. Therefore, all data are described on four green houses (2,000 m<sup>2</sup>).
- 2) Investment: construction of house (4 houses of 500 m<sup>2</sup> each), water tank (1), generator for emergency (1), heater (4), irrigation facilities (2000m<sup>2</sup>), lighting facilities (1), etc. Investment for fixed assets is 118.511 million Rls.
- 3) Production of cucumber in green house is carried out two times a year as shown in Fig. A8.3.1.
- 4) Annual running cost is about 31 million Rls. in total of 4 houses. That in one house of 500 m<sup>2</sup> is 7.8 million Rls.
- 5) Average yield of cucumber included 2 times cultivation is 20kg per m<sup>2</sup>. Therefore, annual production in 500 m<sup>2</sup> of green house is 10 tons.
- 6) Gross income in 500 m<sup>2</sup> of green house is 15 million Rls.
- 7) Amount of annual repayment of loan is about 18 million Rls. in total of 4 houses. That in one house of 500 m<sup>2</sup> is 4.5 million Rls. in case of 10 years of term of repayment. In case of 5 years of term of repayment, annual repayment of loan is about 27 million Rls. in total of 4 houses. That in one house of 500 m<sup>2</sup> is 6.8 million Rls.
- 8) Net income except repayment of loan is about 29 million Rls. in total of 4 houses and for each house of 500 m<sup>2</sup>, the net income is 7.25 million Rls.
- 9) Net income during 10 years of repayment of loan is about 11 million Rls. in total of 4 houses in case of 10 years of repayment term, and about 7 million Rls. in total of 4 houses in case of 5 years of repayment term, respectively.

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

Table A8.3.9 Production, income and cost of cucumber cultivation in plastic green house

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

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

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

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

## (6) Supporting Plans

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

### 1) Technical Aspects

Main required supports required are as follows;

- a) Strengthening of staff of Jihad-e-Agriculture Organization and extension service center: Increase of staff of irrigation engineer, of cultivation technology of green house, of supervisor of mechanization, and of animal husbandry.
- b) Execution of 'project of technological development research' to carry out the trials and to verify the integrated farming in Tazeh Abad Project Area.
- c) Improvement of supply system of farmer materials in required period and at the optimum time.
- d) Expansion of Government's guaranteed prices to other important crops; apply to hay of grass
- e) Improvement of extension under condition of low literacy rate and religious custom. Increase of exhibition fields, meeting under participation of the clergyman, etc.

### 2) Marketing

#### a. Objectives

In order to increase farmers' income, it is required that the production should reach markets and be sold at the price that can create benefit for them. The markets of present products produced in Tazeh Abad Project Area are ensured. But there are some problems that should be solved as mentioned in section 6.1.2. Establishing a marketing section in RPC Pavand is proposed as one of the solutions for this in the RPC Pavand Strengthening Plan. Hereinafter, supply of the materials to agro-processing factories is proposed as one of the methods obtaining the markets for newly produced crops such as cucumber and peas, planned in A8.3 Basic Guidelines of the Agricultural Development Model.

#### b. Processing of Agricultural Products

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



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

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

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

### 3) Agricultural Finance

#### a. Objectives

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

## b. Agricultural Credit System

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

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

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

### Stage I: Strengthening of present agricultural finance activities

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

### Stage II: Independence from RCO as a financial organization

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

### A8.3.3 Irrigation and Drainage Facilities Development Plan

#### (1) Design of the Irrigation and Drainage Facilities

##### 1) Water Source Facility

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

##### 1. Utilization of the existing pump intake facility

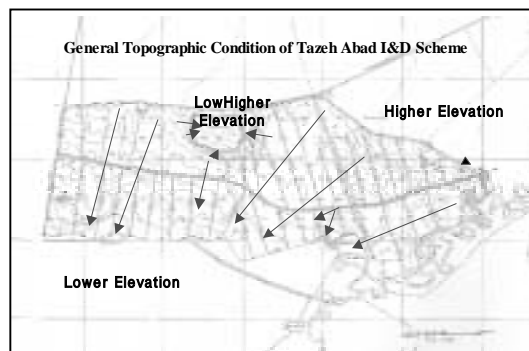
None of the major constraints of the existing pump station, which was completed 4 years before, are not reported, excluding the suction of sediment. It will be required to set measures of river improvement, provision of de-silting chamber and intake chamber for avoiding the aspect.

##### 2. De-silting pond

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

##### 3. Farm pond for irrigation in dry season

Presently a farm pond for irrigation in dry season is under construction in the central area of the scheme. Total area prepared for the facility is 170ha, area for the pond is 150ha and the total capacity of the storage is 4MCM. The objective of this pond is to serve irrigation water in dry season for 600ha farm area in the downstream area of the scheme. The pond is located at an



elevation of 41.0m. The farmland in upstream of the scheme is in between elevation of 47 to 43.0m, and therefore pump station will be required to convey it to upstream area.

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

## 2) Irrigation Facility

### 1. Main Irrigation Canal

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

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

### 2. Secondary Irrigation Canal

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

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

### 3. Tertiary Irrigation Canal

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

### 4. Design for Irrigation Related Facilities

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

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

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

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

#### 1. Secondary Drainage Canal

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

#### 2. Main drainage canal

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

#### 3. New drainage canal

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

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

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

#### 4) Land consolidation

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

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

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

#### 5) Farm Road

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

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

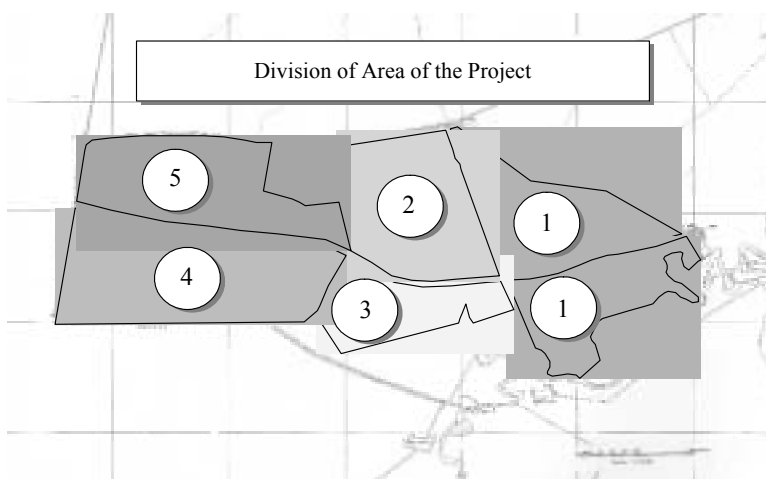
1) Division of the Project Area

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

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

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

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

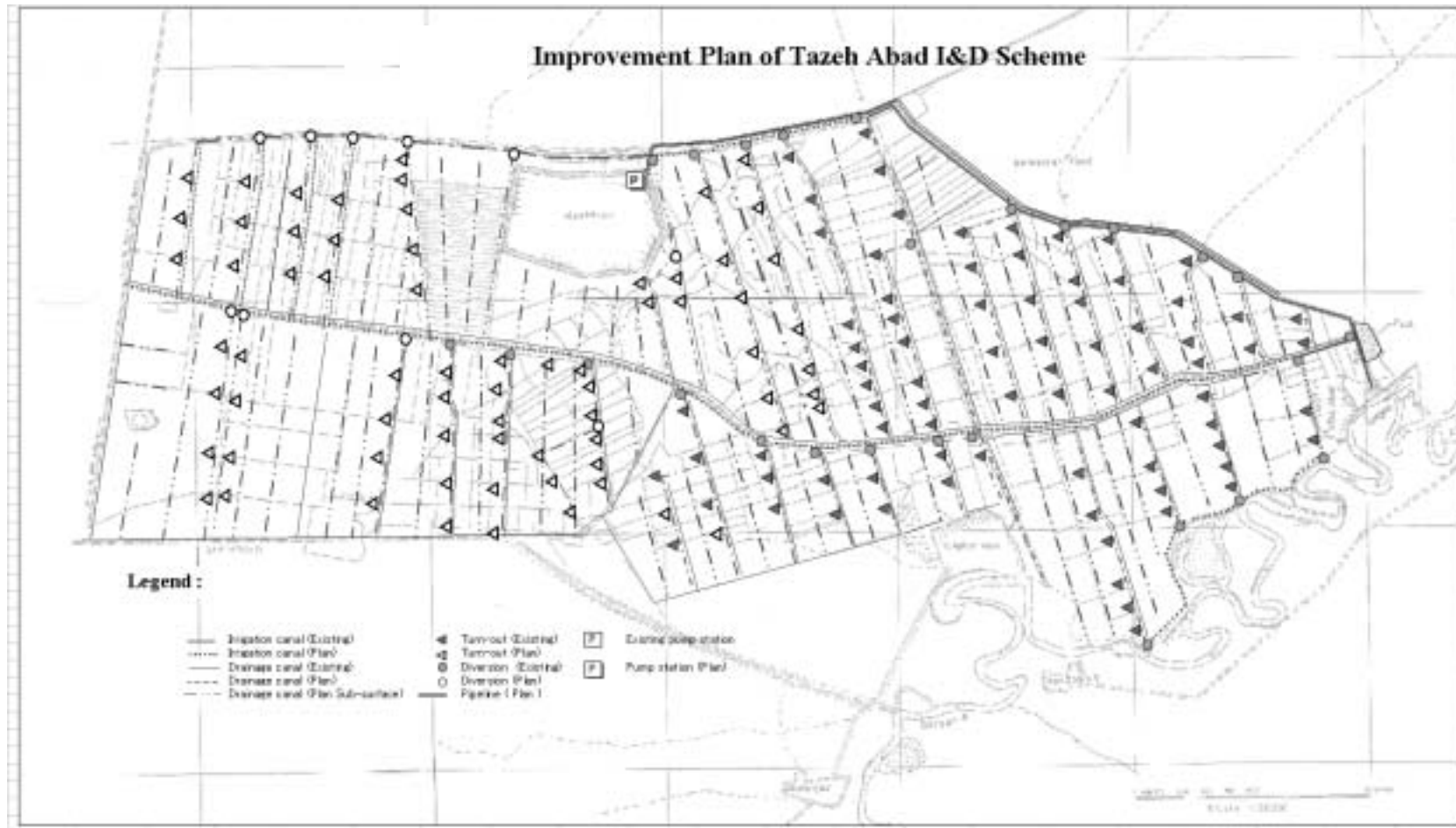


2) Details of Facilities to be Constructed and Works to be Done

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

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





#### (4) Implementation Schedule

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

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

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

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

##### 1) Preparatory and Detailed Design Phase

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

##### 2) Construction Phase

###### 1. Land Acquisition

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

###### 2. Implementation of Construction Works

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

## Implementation Schedule of the Facilities to be Constructed

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

### (5) Cost of Irrigation and Drainage Facilities

#### 1) Conditions

The cost is estimated base on the following conditions:

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

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

- d. The exchange rate used is US\$ 1.00 = Iranian Rial 8,000 as of October 2002; and
- e. The physical contingency is set as 10% of the construction cost and other costs. The economic contingency is set as 3% per annum.

## 2) Construction Cost

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

The total construction cost is estimated to be 21,341.6 x10<sup>6</sup> Rials as shown in the table below:

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

## 3) Land Acquisition Cost

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

## 4) Administration Cost

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

5) Consulting Services Cost

The cost for the provision of the consulting services is estimated as 225.9 x 10<sup>6</sup> Rials.

6) Total Cost

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

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

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

(6) Operation and Maintenance

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

The main operation and maintenance activities are as follows:

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

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

The annual operation and maintenance cost is 96,050,000 Rials as shown in the following table. Furthermore, some of the mechanical items and heavy equipment shall be renewed due to their

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

shorter durability than the Project life. Sixty percent (60%) of the initial cost of pump equipment, pipes and gates or 504 x10<sup>3</sup> Rials as the replacement in 15 years after new installation is estimated and used for the evaluation of the Project.

### A8.3.4 RPC Pavand Strengthening Plan

#### (1) Objectives of RPC Pavand Strengthening Plan

RPC Pavand is established to contribute to increasing members' income through stable production and reduction of the production cost for poverty alleviation. RPC Pavand has a good President and tries to meet various demands from the members under the constraints such as shortage of water, delay of infrastructure's construction, limitation of available finance, shortage of staff and agricultural machinery and so on. In order to overcome these constraints and aim at more effective activities, the RPC should enhance present functions and add new functions. Moreover, the strengthened RPC Pavand should be corresponding to 'Agricultural Development Model' and 'Irrigation and Drainage Facilities Development Plan' proposed in A8.3 and A8.4 respectively. Implementing agencies, terms, and contents of RPC Pavand Strengthening Plan in each Stage is summarized in the table below.

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

#### (2) Organization Functions

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

##### 1) Present enhancing functions

###### 1. Policy making

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

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

## 2. Supply of agricultural inputs

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

## 3. Collective gathering and forwarding activities

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

## 4. Extension service

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

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

## 5. Water distribution

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

## 2) Newly added functions

### 1. Agricultural finance

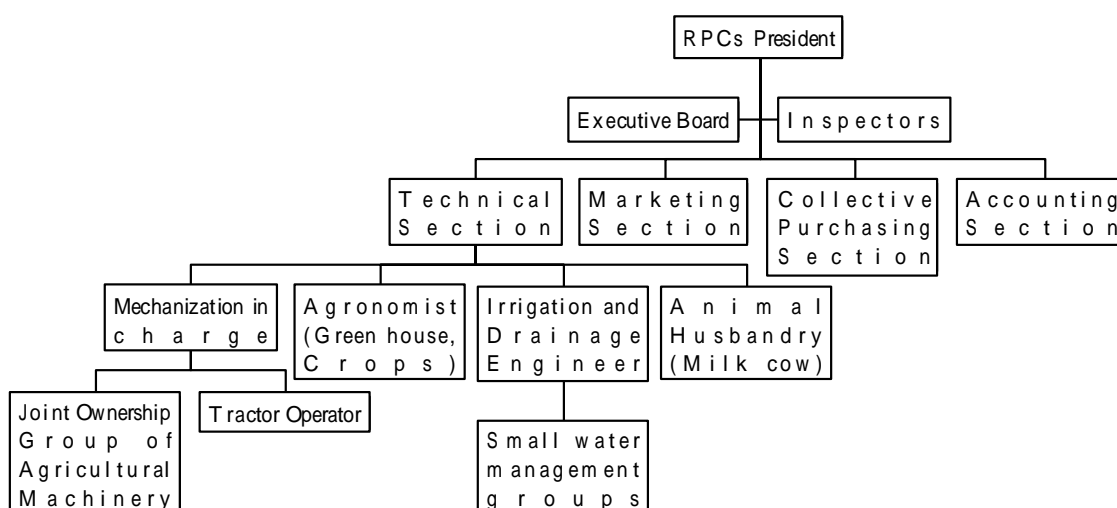
The other serious problem is shortage of fund for farming. In order to solve this problem, it is necessary for the RPC to attribute independent agricultural finance function. Initial funds could be borrowed from Agricultural Bank or international financial organizations such as IFAD (International Fund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

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

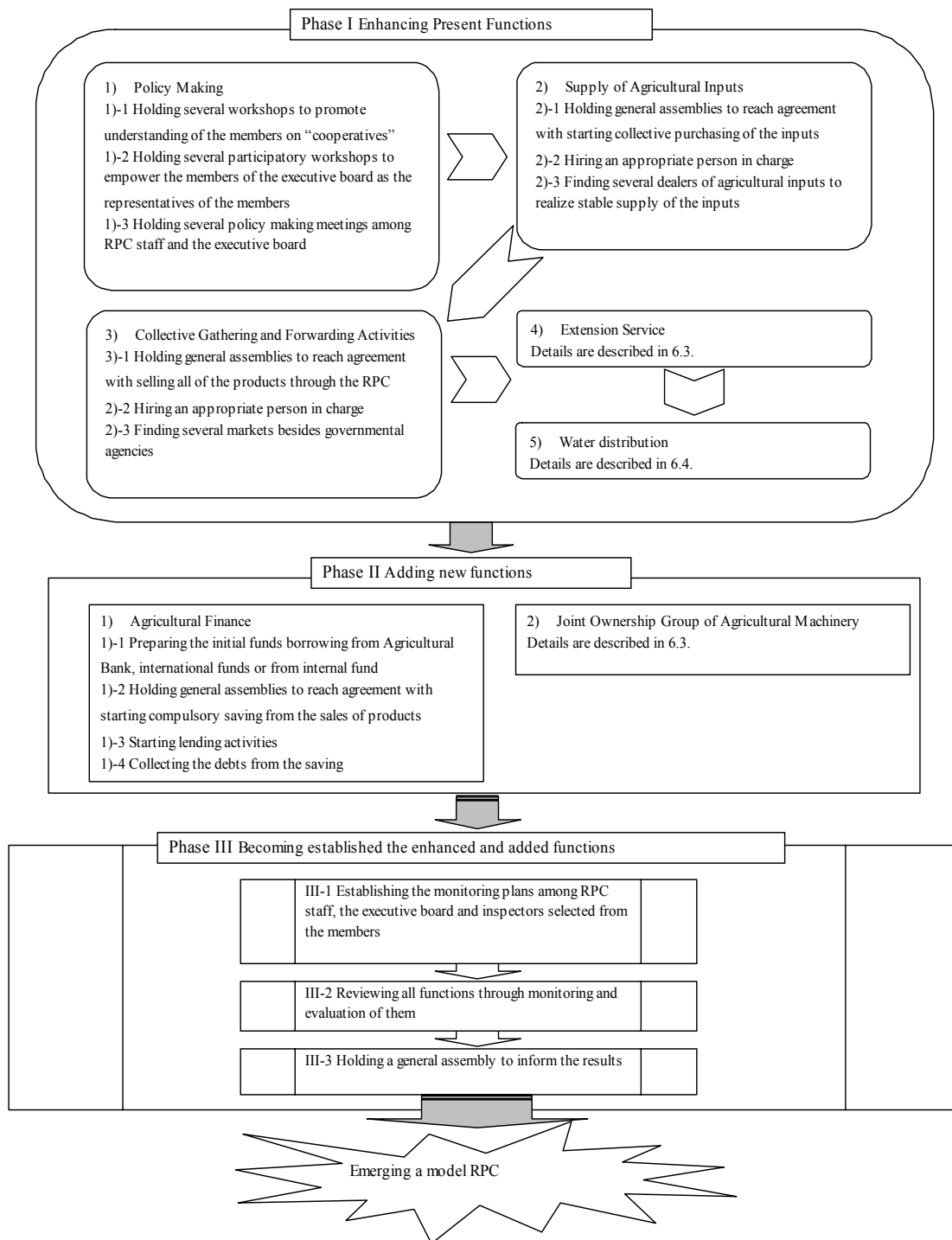
Joint ownership group of agricultural machinery will be formed corresponding to 'Agricultural Development Plan' in order to solve the shortage of machinery and to reduce the production cost. The RPC will guide and supervise these groups. More details are described in A8.3. Procedures of each step are shown in Fig.A8.3.3.

### (3) Structure of the Organization

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







**Fig. A8.3.3 Procedure of Strengthening RPC Pavand**

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

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

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

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

(5) Cost Estimation for RPC Pavand Strengthening Plan

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

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

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

#### A8.4 Implementation Plan of the Project

##### A8.4.1 Project Components and the Project Cost

(1) Project Components

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

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

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

(2) Project Cost

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

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

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

#### A8.4.2 Project Implementation Schedule

The project implementation schedule is shown in the following table.

Project Implementation Schedule

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

#### A8.4.3 Project Implementation Organization

(1) Project Implementation Agency

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

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

## (2) Project Implementation Method

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

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

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

### **A8.5 Projects to be Implemented in Phase - 1**

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

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

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

#### **A8.5.1 Technical Development Project**

##### (1) Necessities of the Project

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

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

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

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

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

## 2) Coordinated Research

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

## 3) Technical Transfer to the Farmers

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

## 4) Communication between Research and Extension Organizations

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

## 5) Coordination with Concerned Agencies of the Province

The Provincial Government has different sections divided vertically and linked to the MOA without the right of local autonomy. It means that the administration of the province is carried out often by the intention and advice of MOA in Tehran. Therefore, a major part of the projects in the province are planned and developed without communication and cooperation

with other sections of the Provincial Government. For example, irrigation and drainage projects are carried out without considering the water availability, soil salinity, sustainable farming and crop rotation. Because of these reasons, it is expected that some projects will have the soil salinity increased year by year, because of dryness and might become waste land after several years.

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

## (2) Effectiveness of Technical Development Project

The effectiveness of the technical development project are as follows:

- a) It is expected to improve the administration system, extension system and research system in Iran, referring to the results of the project as a model. Therefore, the results of the project should be expanded to similar regions in other parts of the country.
- b) The development of technology will become effective, and feasible projects of the Provincial Government shall be carried out by integration of various sections of administration, extension and fields of researches. Besides, the participation of the extension section will permit to raise the level of the extension-workers and an effective extension to the Study Area are expected.

## (3) Contents of the Project

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

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

### 1) Experimental Farming

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

The integrated and the most suitable farming for the project area region will be found out

based on the results of experimental farming during the first 3 years.

## 2) Verification Farming

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

## 3) Research Subjects

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

### 1. Agriculture Technology

- a) To establish sustainable crop rotation by introducing pastures, vegetables, and pulses (selection of suitable pastures, cropping pattern, mechanization, methods of irrigation, establishment of production techniques of silage and hay)
- b) To integrate agriculture and animal husbandry (production and feeding of high quality roughage)
- c) To plan optimal farm size
- d) To verify the effect of windbreak trees and their monitoring and evaluation

### 2. Irrigation and Drainage

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

### 3. Soils

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

### 4. Cooperatives

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

### 5. Processing and Marketing

- a) To study the possibility of food processing aiming at exporting of grain, dairy products,

etc.

b) To improve the supply system of farm materials and the marketing system

## 6. Overall Farm Management

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

(4) Requirements of the Project

1) Researchers

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

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

Apart from these major experts, experts including marketing expert, computer system engineer (to set up workstation and link with internet and Golestan Agriculture Organization) and other experts shall be assigned on a temporary assignment basis, based on the necessity during the progress of experimental and verification farming

2) Supporting Staff and Laboratory Personnel

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

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

3) Farm and Research Facilities

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

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

4) Machinery and Equipment

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



equipment are required for the farm.

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

#### 5) Total Cost

##### 1. Farm Area

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

##### 2. Project Office at the Project Site with Furniture

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

- a) Main Office and administration building
- b) Laboratory building

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

##### 3. Cost for the farm machinery and equipment

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

##### 4. Yearly Running Cost

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

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

(5) Participating organizations

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

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

(6) Foreign Collaboration

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

#### **A8.6 Basic Guidelines of the Agricultural Development of Cheldin Project Area**

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

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

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

(1) Cropping system

The proposed cropping system is one of the models of crop rotation. The model can make

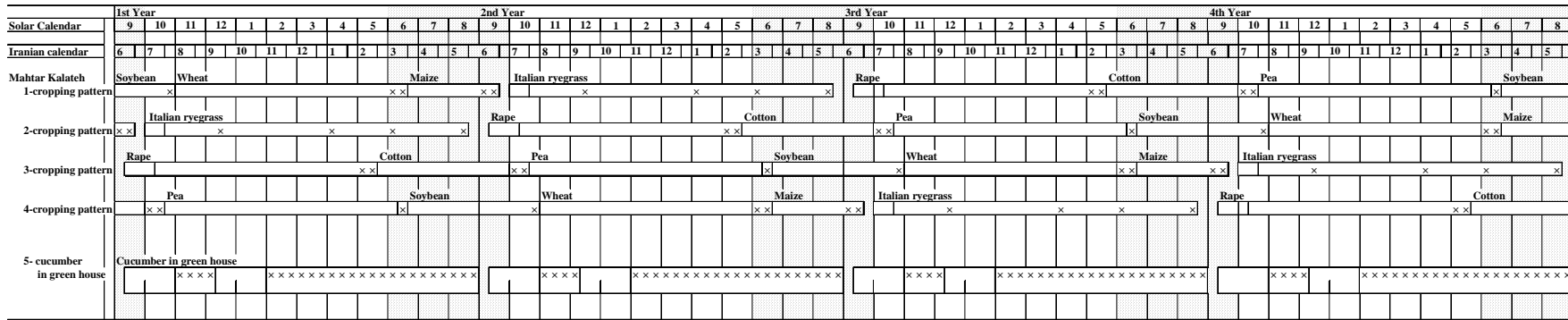
various variations by change of crops, especially, the small-scaled farmers could not help introducing vegetables in exchange for cotton and pea in order to increase the profits..


The proposed rotation is as follows:

- 8 ) The four-year rotation is adopted, because the number of main crops in winter is four (Fig. A8.6.1).
  - 9 ) The composed crops in the rotation are 7 crops, such as wheat, annual grass (Italian ryegrass), rape, cotton, pea, soybean and grain maize for fodder. Crop rotation is made by combination of growth periods of crops.
  - 10 ) The cropping pattern is “wheat – maize – Italian ryegrass – rape – cotton – pea - soybean”.
  - 11 ) In the plan, a farmer divides his field into four plots and cultivates four cropping patterns every year. Therefore, a farmer produces 7 crops every year to keep balance of agricultural income every year.
  - 12 ) The reasons of selecting of these crops were described in Chapter 6.
  - 13 ) These crops should be examined before introduction in the project area, especially on pea and Italian ryegrass.
- (2) Animal husbandry

The proposed plan is same as the plan in Tazeh-abad.

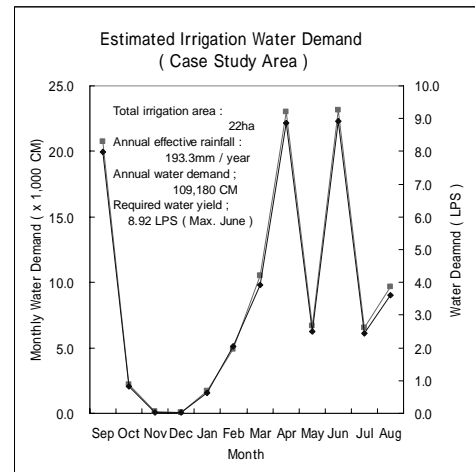
Fig. A8.6.1 Growth Period and Rotation of Crops (Plan for Mahtar Kalateh)



- Note
- 1) □ Sowing ● - Transplanting □ - Irrigation × - Harvesting
  - 2)  Dry season
  - 3) In the both survey area, the four-year crop rotation is adopted. The composed crops in the rotation are wheat, rape, grasses ( Italian ryegrass) or clover, pulse crops (pea) as winter crops, and cotton, soybean and maize as summer crops.
  - 4) Livestock farming, which each farmer raises mother cows of 10 heads, is carried out by each farmer besides above mentioned farming.
  - 5) In small scale farm households, cucumber cultivation through out the year in a greenhouse is introduced.

### (3) Irrigation Water Requirement of the Area

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



Solar Calendar		9	10	11	12	1	2	3	4	5	6	7	8
Iranian calendar		6	7	8	9	10	11	12	1	2	3	4	5
1st year block	1-cropping pattern	Soybean		Wheat								Maize	
	2-cropping pattern	Maize		Italian ryegrass									
	3-cropping pattern	Rape								Cotton			
	4-cropping pattern	Cotton		Pea								Soybean	
2nd year block	1-cropping pattern	Maize		Italian ryegrass									
	2-cropping pattern	Rape								Cotton			
	3-cropping pattern	Cotton		Pea								Soybean	
	4-cropping pattern	Soybean		Wheat								Maize	
3rd year block	1-cropping pattern	Rape								Cotton			
	2-cropping pattern	Cotton		Pea								Soybean	
	3-cropping pattern	Soybean		Wheat								Maize	
	4-cropping pattern	Maize		Italian ryegrass									
4th year block	1-cropping pattern	Cotton		Pea								Soybean	
	2-cropping pattern	Wheat										Maize	
	3-cropping pattern	Maize		Italian ryegrass									
	4-cropping pattern	Rape								Cotton			
Green House	0.25ha		Cucumber in green house										
Water demand ( x 1,000 CM/month)		20.73	2.18	0.11	0.08	1.71	4.93	10.48	22.98	6.68	23.12	6.53	9.65
Water demand ( LPS 24hr run )		8.00	0.81	0.04	0.03	0.64	2.04	3.91	8.87	2.49	8.92	2.44	3.60

Proposed Cropping patter and Monthly Irrigation Requirement

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

When the farmer cultivated each cropping pattern in every one ha, the annual profits by cultivation of seven crops are as shown in Table A8.6.1. From the Table, the net income of cultivation of 4 ha is about 11.443 million Rls.

Table A8.6.1 Annual Profits by Crops (average in Golestan Province, 2001; for Mahtar Kalateh)

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

Note: 1) Yields of cotton, wheat, soybean, rape, pea and maize are used the average in cheldin. Yields of grass and pea are the estimated figures.

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

3) Cost and unit price of grass are estimated in Table A8.6.6.

(5) Economy of the integrated farming model

Annual profits in the integrated farming of agriculture of 4 ha and animal husbandry of hybrid cows of 10 heads are shown in Table A8.6.2. In this case, the average in Cheldin area is used as yields of cotton, wheat, rape, maize, soybean and pea. Estimated figure was used for yield of grass. Besides, the average in Golestan Province is used as costs and unit prices of crops, except grass. The net incomes are composed of 2.3 million Rls. of wheat, 3.5 million Rls. of rape, 1.5 million Rls. of grass, 0.9 million Rls. of pea, 2.2 million Rls. of cotton, 0.9 million Rls. of soybean, 0.1 million Rls. of maize and 24.5 million Rls. of stock farming, and 36.0 million Rls. in total.

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

On the other hand, in case of the same integrated farming with high level of technology (Table A8.6.3), the net incomes are composed of 4.1 million Rls. of wheat, 6.0 million Rls. of rape, 1.5 million Rls. of grass, 2.2 million Rls. of pea, 3.2 million Rls. of cotton, 2.0 million Rls. of soybean, 0.3 million Rls. of maize and 24.5 million Rls. of stock farming, 43.9 million Rls. in total.

Table A8.6.2 Annual Profits of Farm household in Farming of 4 ha in Mehtar Kalateh (Average Plan)  
(7 crops cultivation under irrigation in 4-years rotation and raising of hybrid local cows of 10 heads)

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

Note: 1) Yields of cotton, wheat, rape, maize, soybean and pea are used the average in Cheldin. Yields of grass are the estimated figures.  
2) Costs and unit prices of crops, except grass, are used the average in Golestan Province.  
3) Cost and unit price of grass are estimated in Table A8.6.6.  
4) Gross income, production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table 6.2.3).

Table A8.6.3 Annual Profits of Farm household in Farming of 4 ha in Mahtar Kalateh (High Level Plan)

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

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

potassium, sulfur, micro-elements, etc. were added with actual cost (Table A8.6.4, A8.6.5).

3) On annual grasses, there is no data on production costs in detail. Therefore, cost of each component of production costs were made with reference to that of wheat and cotton. 4 tons of hay was estimated as total yield per ha of 3 times harvesting (Table A8.6.6).

4) Gross income, production cost and net income in hybrid cow farming of 10 heads were used the results of the case study in 2001 of the husbandry department, Golestan Jihad-e-Agriculture Organization (Table A8.3.3).

However, during 5 years of repayment of loan, the profit of stock farming is about 5 million Rls. Therefore, annual profits of the integrated farming become about 25 million Rls. In this case, with regard to yields, the highest yield of cotton, wheat, and rape in Cheldin at present are used as yields in the Table. Yields are 5 tons per ha of wheat, 3.5 tons per ha of rape, 4 tons per ha of grass, 2 tons per ha of pea, and 3 tons per ha of cotton, 2.2 tons per ha of soybean, 3 tons per ha of maize, respectively. Data of yield of grass is the estimated figures. Data of production costs of wheat, cotton, rape, pea, soybean, maize and grass were examined about each component of production costs. The average (2000 ~ 2001) in Golestan Province was generally used. Besides, the necessary fertilizers, such as potassium, sulfur, micro-elements, etc., were added with actual costs (Table A8.6.4 and A8.6.5). On annual grass (Italian ryegrass), each component of production costs is made with reference to that of wheat and cotton (Table A8.6.6).

Table A8.6.4 Cultivation Method and Production Cost (wheat under irrigation, for Mahtar Kalateh)

<b>Farm Materials</b>					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Sterilizing seeds	kg	180	11,300	203,400	
Fertilizer (phosphate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potassium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	hours	12	25,000	300,000	
Pesticide	kg	2	14,000	28,000	Sevine
Herbicide	litter & kg	1 lit. + 15 g	79,400	79,400	Topic, grand Star
Insurance due				8,000	
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (drill)		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		2	15,000	30,000	
Irrigation water charge		2	30,000	60,000	
Spraying pesticide		2	25,000	50,000	
Harvesting (with combine)		1	200,000	200,000	
Transporting products to market				35,000	
<b>Total cost</b>				<b>1,469,300</b>	
<b>Income by sale of straw</b>				<b>360,000</b>	200packs, each 1,800 Rls
<b>Net production cost</b>				<b>1,109,300</b>	



Note :

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

Table A8.6.5 Cultivation Method and Production Cost (Cotton under irrigation, for Mahtar Kalateh)

Farm Materials					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seed	kg	40	2050	82000	
Fertilizer (phosphate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	150	315	4,725	
Fertilizer (Potassium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	hours	28	30,000	840,000	6 inch well, 7 hrs x 4 times
Pesticide	kg	12	20,000	240,000	
Herbicide	litter	2.5		28,500	Sonalan
Insurance due				14,000	
Plowing	ha	1.5	75,000	112,500	
Disc harrow	ha	4	37,500	150,000	
Sowing (drill)	ha	1	40,000	40,000	
Making drain	ha	1	30,000	30,000	
Pesticide	ha	1	30,000	30,000	
Transporting seeds and fertilizer	ha	1	12,000	12,000	
Fertilization	ha	2	15,000	30,000	
Weeding	ha		-	559,000	Manual (33 personsx13,000
Cultivator	ha			25,000	Rls), car(8,000Rls)
Spraying pesticide	ha	4	30,000	120,000	and oversee worker (50,000 Rls)
Irrigation		4	30,000	240,000	Manual (4 times x 2 persons)
Harvesting (with combine)	ha			945,000	Manual (labor 57 x 15,000Rls,
Transporting products to market	kg	2,200	40	88,000	oversee worker 3 x 25,000Rls, car
Other cost				295,400	8,000Rls
Profit of fund				271,380	
profit of management				647,353	
Other cost				295,400	
Total cost				5,329,258	

Note :

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

Table A8.6.6 Cultivation Method and Production Cost (Italian ryegrass under Irrigation/for Mahtar Kalateh)

Farm Materials					
Items	Unit	Quantity kg/ha	Unit price Rls/kg	Cost Rls/ha	Remarks
Seeds	kg	20	8,000	160,000	Grass; Setaria (glauca)  6 inch well
Fertilizer (phosphate)	kg	100	450	45,000	
Fertilizer (Urea)	kg	100	315	31,500	
Fertilizer (Potassium)	kg	75	380	28,500	
Agriculture sulfur	kg	200	275	55,000	
Zinc sulfate	kg	40	1,050	42,000	
Manganese sulfate	kg	20	2,925	58,500	
Irrigation water charge	hours	24	25,000	600,000	
Insurance due				8,000	
Plowing		1	60,000	60,000	
Disc harrow		3	30,000	90,000	
Sowing (broadcast seeding )		1	40,000	40,000	
Making drain		1	15,000	15,000	
Transporting seeds and fertilizer			10,000	10,000	
Fertilization		3	15,000	45,000	
Irrigation water charge		2	30,000	60,000	
Harvesting		3 times x 5 processes	20,000	300,000	
Transporting products		3	35,000	105,000	
Total cost				1,753,500	

Note:

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

From the Table A8.6.3, the total farmers' profits in the Case Study area of 26.8 ha and 12 farm households are 129 million Rls. by crop cultivation, 294 million Rls. by animal husbandry, 423 million Rls. in total, respectively.

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

### A8.7 Suggestions for Future Study

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

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

#### A8.7.1 Drainage Related Aspects

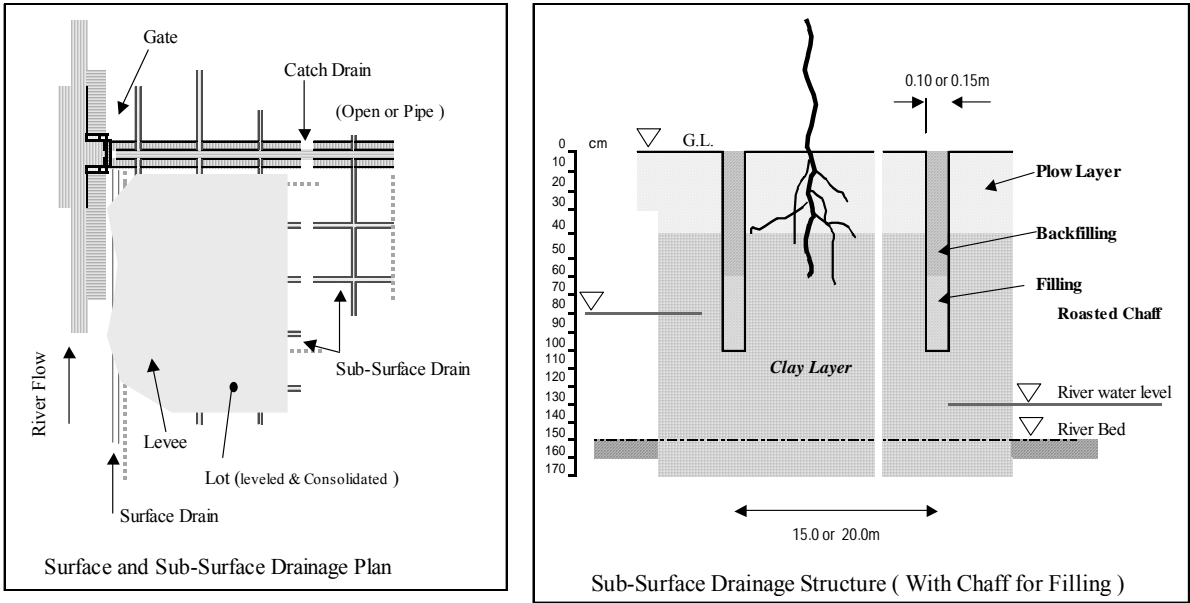
As it was already discussed, the soil texture in the Case Study area is heavy clay and therefore,

the following aspects are to be proposed as solution options, which shall be studied in more detail in the future study.

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

(1) Sub-surface drainage system

Sub-surface drainage system shall be introduced and placed for sub-surface soil improvement, which is prevailed with clay. The system is to adapt chaff as filling material at 1.0m depth from the ground surface level. Width of ditch is assumed as 10 or 15cm considering the thickness of trencher. Thickness of the filling material is assumed 30cm tentatively. Chaff is available to purchase in the vicinity area. This sub-surface drainage system shall be placed as grid system in the Case Study area, with 15 or 20m intervals. The sub-surface drainage utilizing chaff had been applied in the very high clay area as countermeasure for soil improvement, from ancient times.



Note : Trial and monitoring are essential before the implementation

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

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

(2) Surface drainage canal

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

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

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

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

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

(4) River improvement of tributaries.

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

#### **A8.7.2 Land Reform Related Aspects**

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

(2) Water Source and Facilities

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

<b>Annex 9</b>	<b>Project Evaluation</b>
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A9.2 Evaluation Method ----- A9 - 1

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## ANNEX 9

### PROJECT EVALUATION

#### A9.1 Principles for Project Evaluation

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

#### A9.2 Evaluation Method

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

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

- (1) The discount rate to be applied for calculating the NPV shall be as follows. Financial evaluation: 11% (Approximate average real interest rate, which is deflated from nominal interest rate taking into account of inflation rate). Economic evaluation :12% (To follow the International Financing Organization employed to similar development projects).
- (2) The prices to be used for financial evaluation shall be those prevailed at the local markets for the middle quarter in 2002. In case of "With" project situation, the financial cost relevant to agricultural credit shall be contemplated. The economic evaluation shall be in accordance with the following principles.
  - ◆ The export (import) parity prices of traded commodity (wheat) are estimated based on the border price. The border price consists of FOB price plus freight and insurance and inland transportation cost. The FOB price in Canada, the main importing country of wheat in Iran was US\$0.136/kg and converted to Rls.1,076. This price is higher than the market price of Rls.1,050. Since the economic evaluation is only for reference, FOB price converted Rls.1,076 shall be employed. On the other hand, the prices for non-traded commodities shall be the same as the market prices (Refer to table A9.2.1).
  - ◆ The imported construction machineries and some of agricultural machineries are calculated with shadow exchange rate between the average of the free market rate (US\$1=Rls.8,007) and non-oil export rate (US\$1=Rls.7,918). The conversion factor for the shadow exchange

rate shall be 1.01 (Refer to Table A9.2.2).

- ◆ From market price, transfer items (financial cost for credit, taxes, irrigation charge, etc) shall be deducted.

- (3) The project life shall be 30 years, in consideration of the design, construction period and the economic lives of the irrigation and drainage facilities.
- (4) Sensitivity analysis to find out how the project return would be affected under change of given variations of the project (10% rise in project costs, 10% decrease of farm-gate prices, 10% reduction of unit yield of agricultural produces) is carried out.

### **A9.3 Financial and Economic Evaluation**

#### **A9.3.1 Project Benefit**

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

#### **(1) Agricultural Products Benefit**

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

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

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

The agricultural products benefit in the market price (financial price) is shown in the following table. By the implementation of the project, the benefit will be increases by 5.5



times as compared to the present conditions and the increment amount is Rls. 6,705 Million. (Refer to Tables A9.3.1~A9.3.7)

Unit : Million Rials

With Project	Without Project	Benefit
8,161.58	2,940.51	5,220.07

## (2) Benefit by Introduction of Hybrid Cow

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

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

The benefit by introduction of hybrid cow for each farm household is shown below (Refer to Table A8.3.8).

Unit : Million Rials

Benefit by Introduction	Present Benefit	Increment
24.52	2.98	21.54

## (3) Benefit by Introduction of Plastic Green House

To increase the agricultural income for the small-scale farmers (land tenure of less than 1 ha) and effective use of irrigation water, 20 units of plastic green houses will be introduced. Cucumber will be cultivated twice in the year. The benefit is shown in the following table (Refer to Table A8.3.9).

Unit : Million Rials

Benefit per Unit	No. of units	Total
7.184	20	143.68

### A9.3.2 Financial and Economic Cost

In pursuance with above-mentioned model for agricultural farming and capital investment, farm-gate price, production cost and cost of capital investment have been calculated for both financial and economic prices as mentioned below (Refer to Tables A9.3.10~A9.3.16 ).

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

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

### A9.3.3 Returns

The returns of financial prices and economic prices are shown as below (Refer to Table A9.3.17).

Item	NPV	FIRR (%)
Returns based on the financial prices	(At discount rate of 12%) Million Rls.20,918	16.2
Returns based on the economic prices	(At discount rate of 11%) Million Rls.31,271	20.3

### A9.3.4 Sensitive Analysis

Sensitivity analysis is carried out with regard to the change of three variations: 1) 10% rise in project costs, 2) 10% decrease of farm-gate prices and 3)10% reduction of unit yield of agricultural produces, and it is disclosed that the present project is more sensitive to change of unit yield of agricultural produces than other two variations (Refer to Tables A9.3.18~A9.3. 35)

**Returns based on the financial prices**

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

**Returns based on the economic prices**

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

**A8.3.5 Financial Analysis**

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

**(1) Investment Costs and Repayment**

The required amount for the project is summarized in the following table. In the improvement of the irrigation and drainage facilities, the Government will assist 80% of the construction costs of main, lateral and tertiary canals. All other costs related to the Project will be borne by the farmers (Refer to Table A9.3.36).

Unit : Million Rials

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

## **(2) Repayment period and Interest**

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

## **(3) Financial Analysis by Cash Flow**

Analysis was carried out for the following cases (Refer to Tables A9.3.3~A9.3.42) .

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

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

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

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

## **A9.4 Socioeconomic Synergy Impact**

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

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

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

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

#### **A9.5 Comprehensive Evaluation**

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

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

**Table A9.2.1 FOB Prices of Wheat, Corn and Soybean**

	FOB US\$/kg	Origin Country	I&F	Inland Trans.	FOB Rials/kg	Market Price in Gorgan
Wheat	0.136	Canada	-	-	1,077	
Corn	0.127	Canada	-	-	1,006	1,050
Soy bean	0.224	Brazil	-	-	1,794	1,770
Pea	1.115	Spanish	-	-	8,928	1,870

Source: Statistical Yearbook of Islamic Republic of Iran's Foreign Trade (2002,2001)  
 Customs of Islamic republic of Iran, compiled by JETRO Tehran

The Economic price will be employed the Border price. The Border price is calculated as (FOB + Freight + Insurance + Inland transportation).

When the FOB price converted to Iranian Rials, the FOB price is higher than the market price in the project site. Taking into consideration this fact, the Economic Evaluation will be made by using the FOB price.

**Table A9.2.2 Exchange Rate**

	1st. Quarter	2nd. Quarter	Average	Conversion rate
Non-oil Export Rate	7,917.99	7919.98	7,918	
Free Market Rate	8,013.27	8000.39	8,007	1.011

Source: Economic Trends No.25 Second Quarter 1380 (2001/2002), Iranian Central Bank  
 Compiled by JETRO Tehran

## Table A9.3.1 Crop Benefit

### 1. With Project : Annual Benefot of Farm household in Farming of 4 ha in Tazeh Abad (High Level Plan)

(5 crops cultivation under irrigation in 4-years rotation and raising of hybrid local cows of 10 heads)

Item	Yield kg/ha	Producers' unit price		Gross income		Production cost		Net income	
		Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic
		Rls./kg		Million Rls./ha		Million Rls./ha		Million Rls./ha	
Crops introduced to the plan									
Wheat	4,000	1,050	1,076	4.200	4.304	1.110	0.999	3.090	3.305
Rape	2,500	2,050	2,050	5.125	5.125	1.214	1.139	3.911	3.986
Grass (hay)	4,000	825	825	3.300	3.300	1.365	1.064	1.935	2.237
Pea	1,500	1,870	1,870	2.805	2.805	1.789	1.488	1.016	1.317
Cotton	2,000	2,850	2,850	5.700	5.700	4.913	4.020	0.787	1.680
Total annual net income of 4 ha in four-year crop rotation								10.739	12.524
Net income for 1ha								2.685	3.131
Total income								8,161.58	
Animal husbandry Raising of hybrid cows of 10 head				49.120	49.120	24.596	24.596	24.524	24.524
Total annual net income								35.263	37.048

### 2. Without Project

Due to the tendency of the unit yield per hectare is declined in the area, the present productivity condition will continue in the case of without project

Crop	Area	yield	Gross Income	Production Cost		Net
	ha	t	Million Rls	Million Rls	Total	Million Rls
Wheat	1,200	2.54	3,201.7	1.07	1,284.0	1,917.66
Rape	80	2.00	328.0	1.00	80.0	248.00
Grass	0				0.0	0.00
Pea	0				0.0	0.00
Cotton	70	1.70	339.9	2.93	205.1	134.85
Barley	800	2.00	1,312.0	0.84	672.0	640.00
Total	2,150		5,181.6		2,241.1	2,940.51

**Table 9.3.2 Production Cost of wheat under irrigation, for Tazeh Abad)**

<b>Farm Materials</b>			Unit price		Cost	
Items	Unit	Quantity kg/ha	Financial Rls/kg	Economic	Financial Rls/ha	Economic
Sterilizing seeds	kg	180	1,130	1,130	203,400	203,400
Fertilizer (phosphate)	kg	100	450	450	45,000	45,000
Fertilizer (Urea)	kg	100	315	315	31,500	31,500
Fertilizer (Potassium)	kg	75	380	380	28,500	28,500
Agriculture sulfur	kg	200	275	275	55,000	55,000
Zinc sulfate	kg	40	1,050	1,050	42,000	42,000
Manganese sulfate	kg	20	2,925	2,925	58,500	58,500
Irrigation water charge	times	4	62,500	62,500	250,000	250,000
Pesticide	kg	2	14,000	14,000	28,000	28,000
Herbicide	litter & kg	1	79,400	79,400	79,400	79,400
Insurance due		1	8,000	8,000	8,000	8,000
Repayment of debts	ha	1	102,000	0	51,000	0
<b>Farm Works</b>						
Items	Unit	Number of times	Unit price Rls		Cost Rls/ha	
Plowing		1	60,000	60,000	60,000	60,000
Disc harrow		3	30,000	30,000	90,000	90,000
Sowing (drill)		1	40,000	40,000	40,000	40,000
Making drain		1	15,000	15,000	15,000	15,000
Transporting seeds and fertilizer		1	10,000	10,000	10,000	10,000
Fertilization		2	15,000	15,000	30,000	30,000
Irrigation water charge		2	30,000	0	60,000	0
Spraying pesticide		2	25,000	25,000	50,000	50,000
Harvesting (with combine)		1	200,000	200,000	200,000	200,000
Transporting products to market		1	35,000	35,000	35,000	35,000
Total cost					1,470,300	1,359,300
Income by sale of straw		1	360,000	360,000	360,000	360,000
Net production cost					1,110,300	999,300



**Table A9.3.3 Production Cost**

**Cotton**

<b>Farm Materials</b>						
Items	Unit	Quantity kg/ha	Unit price		Cost	
			Financial Rls/kg	Economic	Financial Rls/ha	Economic
Seed	kg	40	2,050	2,050	82,000	82,000
Fertilizer (phosphate)	kg	100	450	450	45,000	45,000
Fertilizer (Urea)	kg	150	315	315	47,250	47,250
Fertilizer (Potassium)	kg	75	380	380	28,500	28,500
Agriculture sulfur	kg	200	275	275	55,000	55,000
Zinc sulfate	kg	40	1,050	1,050	42,000	42,000
Manganese sulfate	kg	20	2,925	2,925	58,500	58,500
Irrigation water charge	times	3	110,000	0	330,000	0
Pesticide	kg	12	20,000	20,000	240,000	240,000
Herbicide	litter	2.5	11,400	11,400	28,500	28,500
Insurance due		1	14,000	14,000	14,000	14,000
Repayment of debts	ha	0.5	102,000	0	51,000	0
<b>Sub total</b>					1,021,750	640,750
<b>Farm Works</b>						
Items	Unit	Number of times	Unit price		Cost	
			Rls		Rls/ha	
Plowing	ha	1.5	75,000	75,000	112,500	112,500
Disc harrow	ha	4	37,500	37,500	150,000	150,000
Sowing (drill)	ha	1	40,000	40,000	40,000	40,000
Making drain	ha	1	30,000	30,000	30,000	30,000
Pesticide	ha	1	30,000	30,000	30,000	30,000
Transporting seeds and fertilizer	ha	1	12,000	12,000	12,000	12,000
Fertilization	ha	2	15,000	15,000	30,000	30,000
Weeding	ha	1	559,000	559,000	559,000	559,000
Cultivator	ha	1	25,000	25,000	25,000	25,000
Spraying pesticide	ha	4	30,000	30,000	120,000	120,000
Irrigation		8	30,000	0	240,000	0
Harvesting (with combine)	ha	1	945,000	945,000	945,000	945,000
Transporting products to market	kg	2,200	40	40	88,000	88,000
Other cost		1	295,400	295,400	295,400	295,400
Profit of fund		1	271,380	0	271,380	0
profit of management		1	647,353	647,353	647,353	647,353
Other cost		1	295,400	295,400	295,400	295,400
<b>Sub total</b>					3,891,033	3,379,653
<b>Total</b>					4,912,783	4,020,403

**Table A9.3.4 Production Cost****Annual Grass**

<b>Farm Materials</b>						
Items	Unit	Quantity kg/ha	Unit price		Cost	
			Financial Rls/kg	Economic	Financial Rls/ha	Economic
Seeds	kg	20	3,500	3,500	70,000	70,000
Fertilizer (phosphate)	kg	100	450	450	45,000	45,000
Fertilizer (Urea)	kg	100	315	315	31,500	31,500
Fertilizer (Potassium)	kg	75	380	380	28,500	28,500
Agriculture sulfur	kg	200	275	275	55,000	55,000
Zinc sulfate	kg	40	1,050	1,050	42,000	42,000
Manganese sulfate	kg	20	2,925	2,925	58,500	58,500
Irrigation water charge	times	3	83,333	0	250,000	0
Insurance due		1	8,000	8,000	8,000	8,000
Repayment of debts	ha	1	102,000	0	51,000	0

**Farm Works**

Items	Unit	Number of times	Unit price Rls		Cost Rls/ha	
Plowing		1	60,000	60,000	60,000	60,000
Disc harrow		3	30,000	30,000	90,000	90,000
Sowing (broadcast seeding )		1	40,000	40,000	40,000	40,000
Making drain		1	15,000	15,000	15,000	15,000
Transporting seeds and fertilizer		1	10,000	10,000	10,000	10,000
Fertilization		3	15,000	15,000	45,000	45,000
Irrigation water charge		2	30,000	30,000	60,000	60,000
Harvesting		15	20,000	20,000	300,000	300,000
Transporting products		3	35,000	35,000	105,000	105,000
Total cost					1,364,500	1,063,500

**Rape**

		Financial	Economic
Land preparation		275,760	275,760
Sowing		148,760	148,760
Management		407,780	407,780
Harvesting		166,280	166,280
Irrigation		75,000	0
Fertilizer & others		140,000	140,000
Total	Million Rls./ha	1.214	1.139

**Pea**

		Economic	Financial
Land preparation		235,330	235,330
Sowing		316,300	316,300
Management		387,660	387,660
Harvesting		384,820	384,820
Irrigation		250,000	0
Fertilizer & others		164,000	164,000
Interest		51,000	0
Total	Million Rls./ha	1.789	1.488

**Table A9.3.5 Initial Stage Benrfit**  
**Net income during the initial stage of the Project**

	Year	Wheat		Rape		Grass		Pea		Cotton		Total net income			
		Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	per 4ha		per ha	
												Financial	Economic	Financial	Economic
Yield	1	3.0	3.0	2.0	2.0	0.0	0.0	0.0	0.0	1.3	1.3				
	2	3.0	3.0	2.0	2.0	0.0	0.0	0.0	0.0	1.5	1.5				
	3	3.3	3.3	2.2	2.2	3.0	3.0	1.0	1.0	1.6	1.6				
	4	3.5	3.5	2.4	2.4	3.5	3.5	1.3	1.3	1.8	1.8				
	5	4.0	4.0	2.5	2.5	4.0	4.0	1.5	1.5	2.0	2.0				
Producer Unit Price (Rials)		1,050.0	1,076.0	2,050.0	2,050.0	825.0	825.0	1,870.0	1,870.0	2,850.0	2,850.0				
Gross Income (Milion Rials)	1	3.150	3.228	4.100	4.100	0.000	0.000	0.000	0.000	3.705	3.705	10.955	11.033		
	2	3.150	3.228	4.100	4.100	0.000	0.000	0.000	0.000	4.275	4.275	11.525	11.603		
	3	3.465	3.551	4.510	4.510	2.475	2.475	1.870	1.870	4.560	4.560	16.880	16.966		
	4	3.675	3.766	4.920	4.920	2.888	2.888	2.431	2.431	5.130	5.130	19.044	19.135		
	5	4.200	4.304	5.125	5.125	3.300	3.300	2.805	2.805	5.700	5.700	21.130	21.234		
												0.000	0.000		
Production Cost Million Rials	1	1.110	0.999	1.214	1.139	0.000	0.000	0.000	0.000	2.930	2.930	5.254	5.068		
	2	1.110	0.999	1.214	1.139	0.000	0.000	0.000	0.000	2.930	2.930	5.254	5.068		
	3	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
	4	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
	5	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
												0.000	0.000		
Net Income Million Rials	1	2.040	2.229	2.886	2.961	0.000	0.000	0.000	0.000	0.775	0.775	5.701	5.965	1.425	1.491
	2	2.040	2.229	2.886	2.961	0.000	0.000	0.000	0.000	1.345	1.345	6.271	6.535	1.568	1.634
	3	2.355	2.552	3.296	3.371	1.110	1.411	0.081	0.382	(0.353)	0.540	6.489	8.256	1.622	2.064
	4	2.565	2.767	3.706	3.781	1.523	1.824	0.642	0.943	0.217	1.110	8.653	10.425	2.163	2.606
	5	3.090	3.305	3.911	3.986	1.935	2.236	1.016	1.317	0.787	1.680	10.739	12.524	2.685	3.131

**Table A9.3.6 Benefit by Financial Cost**

		With Project (Million Riials)							Without		
Year		Crops			G. House	Cow			Total	Project	Balance
		Area	per ha	Total	20 houses	per farmer	Farmer	Total	Amount		
1	2004	1,000.00	1.425	1,425.250	0.000	0.000	0	0.000	1,425.3	134.848	1,290.4
2	2005	1,400.00	1.568	2,194.850	143.675	21.544	57	1,228.008	3,566.5	2,940.508	626.0
3	2006	1,646.00	1.622	2,670.224	143.675	21.544	57	1,228.008	4,041.9	2,940.508	1,101.4
4	2007	2,014.00	2.163	4,356.534	143.675	21.544	57	1,228.008	5,728.2	2,940.508	2,787.7
5	2008	2,382.00	2.685	6,395.075	143.675	21.544	179	3,856.376	10,395.1	2,940.508	7,454.6
6	2009	3,040.00	2.685	8,161.640	143.675	21.544	179	3,856.376	12,161.7	2,940.508	9,221.2
7	2010	3,040.00	2.685	8,161.640	143.675	21.544	179	3,856.376	12,161.7	2,940.508	9,221.2
8	2011	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
9	2012	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
10	2013	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
11	2014	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
12	2015	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
13	2016	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
14	2017	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
15	2018	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
16	2019	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
17	2020	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
18	2021	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
19	2022	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
20	2023	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
21	2024	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
22	2025	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
23	2026	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
24	2027	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
25	2028	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
26	2029	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
27	2030	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
28	2031	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
29	2032	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5
30	2033	3,040.00	2.685	8,161.640	143.675	21.544	367	7,906.648	16,212.0	2,940.508	13,271.5

**Table A9.3.7 Benefit by Economic Cost**

Year	With Project (Million Rials)								Without		
	Crops			G. House	Cow			Total	Project	Balance	
	Area	per ha	Total	20 houses	per farmer	Farmer	Total	Amount			
1	2004	1,000.00	1.491	1,491.250	0.000	0.000	0	0.000	1,491.3	134.848	1,356.4
2	2005	1,400.00	1.634	2,287.250	143.675	25.790	57	1,470.030	3,901.0	2,940.508	960.4
3	2006	1,646.00	2.064	3,397.262	143.675	25.790	57	1,470.030	5,011.0	2,940.508	2,070.5
4	2007	2,014.00	2.606	5,248.736	143.675	25.790	57	1,470.030	6,862.4	2,940.508	3,921.9
5	2008	2,382.00	3.131	7,458.042	143.675	25.790	179	4,616.410	12,218.1	2,940.508	9,277.6
6	2009	3,040.00	3.131	9,518.240	143.675	25.790	179	4,616.410	14,278.3	2,940.508	11,337.8
7	2010	3,040.00	3.131	9,518.240	143.675	25.790	179	4,616.410	14,278.3	2,940.508	11,337.8
8	2011	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
9	2012	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
10	2013	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
11	2014	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
12	2015	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
13	2016	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
14	2017	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
15	2018	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
16	2019	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
17	2020	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
18	2021	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
19	2022	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
20	2023	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
21	2024	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
22	2025	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
23	2026	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
24	2027	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
25	2028	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
26	2029	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
27	2030	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
28	2031	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
29	2032	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3
30	2033	3,040.00	3.131	9,518.240	143.675	25.790	367	9,464.930	19,126.8	2,940.508	16,186.3

**Table A9.3.8 Hybrid Cow Farming of 10 Heads**

No.	Items	Unit price		Quantity	Amount	
		Financial	Economic		Financial	Economic
		Rls			Million Rls.	
1	Investment					
1)	Buildings					
	Mother cow stall	170,000	170,000.0	40.0	6.800	6.800
	Female cow (2 years old) stall	170,000	170,000.0	10.0	1.700	1.700
	Cow (1 year old) stall	170,000	170,000.0	10.0	1.700	1.700
	Calves stall	230,000	230,000.0	8.0	1.840	1.840
	Storage room of concentrate feed	250,000	250,000.0	12.0	3.000	3.000
	Paddock	43,000	43,000.0	80.0	3.440	3.440
	Feeder	924,000	924,000.0	1.0	0.924	0.924
	<b>Sum</b>				<b>19.404</b>	<b>19.404</b>
2)	Facilities			unit		
	Milker	3,000,000	3,000,000.0	1.0	3.000	3.000
	Sterilizer	3,500,000	3,500,000.0	1.0	3.500	3.500
	Milk-storage tank	500,000	500,000.0	1.0	0.500	0.500
	Others	350,000	350,000.0	1.0	0.350	0.350
	<b>Sum</b>				<b>7.350</b>	<b>7.350</b>
	Total of Building and Equip				<b>26.754</b>	<b>26.754</b>
3)	Purchase of 10 heads cows	5,500,000	5,500,000.0	10.0	55.000	<b>55.000</b>
	<b>Total</b>				<b>81.754</b>	<b>81.754</b>
2	Annual running cost					
	Medicines, sanitary goods, vaccine	1,250,000	1,250,000.0	1.0	1.250	1.250
	Charges of water and electricity	500,000	500,000.0	1.0	0.500	0.500
	Fuel charge	500,000	500,000.0	1.0	0.500	0.500
	Concentrate feed kg	860	860.0	15,000.0	12.900	12.900
	Hay kg	300	300.0	25,000.0	7.500	7.500
	Others	680,000	680,000.0	1.0	0.680	0.680
	<b>Sum</b>				<b>23.330</b>	<b>23.330</b>
3	Annual total cost					
	Depreciation of building	776,000	0.0	1.0	0.776	0.000
	Depreciation of facilities	490,000	0.0	1.0	0.490	0.000
	Running cost	23,330,000	23,330,000.0	1.0	23.330	23.330
	<b>Sum</b>				<b>24.596</b>	<b>23.330</b>
4	Annual gross income					
	Sale of milk	1,490	1,490.0	18,000.0	26.820	26.820
	Sale of bull (1 year old)	2,500,000	2,500,000.0	4.0	10.000	10.000
	Sale of cow (over 2 years old)	3,000,000	3,000,000.0	4.0	12.000	12.000
	Sale of manure (ton)	15,000	15,000.0	20.0	0.300	0.300
	<b>Sum</b>				<b>49.120</b>	<b>49.120</b>
5	Balance				<b>24.524</b>	<b>25.790</b>

**A Existing Condition of Cow breeding**

There is no available data of the actual numbers of cows in the area, the estimation is made as following manner;

Based on the results of the hearing, half to the farmers of the area have two to ten cows.

If half of the 375 framers in the cad aster have 5 cows, 940 cows ( 375/2 x 5=938) are breaded.

The milk production of each cow is annually 800 litter, and the sales price per litter is 1,490 rials

Thus, the benefit of the each farmer in the present condition is as follows;

$$800 \times 1,490 \times 5 = 5.96 \text{ Million rials/farmer}$$

**B Cow introduction schedule**

Year	Nos. of Farmers
1	57 farmers (land tenure over 10ha) 16%
2	
3	
4	122 farmers (land tenure between 5ha to 10ha) 33%
5	
6	
7	188 farmers (land tenure less than 5ha) 51%

**C The milk production will start one year after of the introduction of cows, and the increment of the benefit between present condition and with project is ;**

Half of farmer will change traditional variety to Hybrid cow.

Therefore, net income is calculated as following manner.

Financial  $\{24.524 + (24.524 - 5.96)\} / 2 = 21.544$  Million rials

Economic  $\{25.79 + (25.79 - 5.96)\} / 2 = 22.81$  Million Rials

#### Benefit Increment

Year	Net Benefit			Increment Benefit				
	Q'ty	Financial	Economic	Unit amount Financial	Economic	Quantity	Amount Financial	Economic
1	0	0.0	0.0			0	0.000	0.000
2	57	1,397.9	1,470.0	21.544	22.810	57	1,228.008	1,300.170
3	57	1,397.9	1,470.0	21.544	22.810	57	1,228.008	1,300.170
4	57	1,397.9	1,470.0	21.544	22.810	57	1,228.008	1,300.170
5	179	4,389.8	4,616.4	21.544	22.810	179	3,856.376	4,082.990
6	179	4,389.8	4,616.4	21.544	22.810	179	3,856.376	4,082.990
7	179	4,389.8	4,616.4	21.544	22.810	179	3,856.376	4,082.990
8	367	9,000.3	9,464.9	21.544	22.810	367	7,906.648	8,371.270
9	367	9,000.3	9,464.9	21.544	22.810	367	7,906.648	8,371.270

#### D Investment Schedule

Replacement for Building & Equipment is 20 and 10 years respectively.

Year	Nos. of Farmers	Introduction				Total Amount	Replacement		Total
		Cow		Building & Equip			Building	Equip	
		Unit cost	Amount	Unit cost	Amount				
1	57	55.0	3,135.0	26.8	1,525.0	4,660.0		4,660.0	
2			0.0	0.0	0.0	0.0		0.0	
3			0.0	55.0	0.0	0.0		0.0	
4	122	55.0	6,710.0	81.8	9,974.0	16,684.0		16,684.0	
5			0.0	0.0	0.0	0.0		0.0	
6			0.0	1.3	0.0	0.0		0.0	
7	188	55.0	10,340.0	0.5	94.0	10,434.0		10,434.0	
8								0.0	
9								0.0	
10								0.0	
11							419.0	419.0	
12								0.0	
13								0.0	
14								0.0	
15								0.0	
16								0.0	
17								0.0	
18								0.0	
19								0.0	
20								0.0	
21							1,106.0	2,002.7	
22								0.0	
23								0.0	
24								0.0	
25								0.0	
26								0.0	
27								0.0	
28								0.0	
29								0.0	
30								0.0	

**Table A9.3.9 Plastic Green House (cucumber cultivation)**

No.	No.	Items	Unit price		Quantity	Amount	
			Financial	Economic		Financial	Economic
			Rls			Million Rls.	
<b>1 Investment</b>							
	1)	Construction and facilities of green house					
		Frame pipe 4x500m2	25,000	25,000	2000	50.000	50.000
		Heater	5,000,000	5,000,000	4	20.000	20.000
		Ventilator	400,000	400,000	8	3.200	3.200
		Irrigation facilities m2	7,500	7,500	2,000	15.000	15.000
		water tank	2,000,000	2,000,000	1	2.000	2.000
		Plastic film m2	1,000	1,000	5,000	5.000	5.000
		Generator	5,000,000	5,000,000	1	5.000	5.000
		Guard and resting house	5,400,000	5,400,000	1	5.400	5.400
		Others	5,288,000	5,288,000	1	5.288	5.288
		<b>Sum</b>				<b>110.888</b>	<b>110.888</b>
	2)	Equipments and implements					221.776
		Sprayer	3,000,000	3,000,000	1	3.000	3.000
		Thermometer	70,000	70,000	4	0.280	0.280
		Thermometer in soil	100,000	100,000	4	0.400	0.400
		Hygrometer	7,000	7,000	4	0.028	0.028
		Scissors with long grips	80,000	80,000	4	0.320	0.320
		Scissors with short grips	20,000	20,000	4	0.080	0.080
		Ordinary scissors	75,000	75,000	4	0.300	0.300
		Hoe	20,000	20,000	4	0.080	0.080
		Trowel	4,000	4,000	10	0.040	0.040
		Handcart	150,000	150,000	2	0.300	0.300
		Lighting facilities	2,000,000	2,000,000	1	2.000	2.000
		Rake	7,000	7,000	4	0.028	0.028
		Thermostat	40,000	40,000	4	0.160	0.160
		Others	363,000	363,000	1	0.363	0.363
		<b>Sum</b>				<b>7.379</b>	<b>7.379</b>
		<b>Grand Total</b>				<b>118.267</b>	<b>118.267</b>
		<b>Investment cost per 1 unit (500m2)</b>				<b>29.567</b>	<b>29.567</b>
<b>3 Running cost (2 times cultivation during a year)</b>							
		Liquid fertilizer	0.400	0.400	1	0.400	0.400
		Chemical fertilizer	0.200	0.200	1	0.200	0.200
		Manure	0.200	0.200	1	0.200	0.200
		String	0.240	0.240	1	0.240	0.240
		Chemicals	0.500	0.500	1	0.500	0.500
		Packing materials	3.000	3.000	1	3.000	3.000
		Fuel	5.400	5.400	1	5.400	5.400
		Electricity	3.000	3.000	1	3.000	3.000
		Shipping	0.600	0.600	1	0.600	0.600
		Wage of laborers	4.200	4.200	1	4.200	4.200
		Hybrid seeds	3.600	3.600	1	3.600	3.600
		Plastic tubes for warm current of air	0.510	0.510	1	0.510	0.510
		Supervisor for part-timers	2.000	2.000	1	2.000	2.000
		Management cost	5.926	5.926	1	5.926	5.926
		Other costs	1.489	1.489	1	1.489	1.489
		<b>Sum</b>				<b>31.265</b>	<b>31.265</b>
<b>4 Balance</b>							
		Total annual cash income (4 green ho	1,500	1,500	40,000	60.000	60.000
		Total annual running cost				31.265	31.265
		<b>Net income</b>				<b>28.735</b>	<b>28.735</b>
		<b>Per house</b>				<b>7.18375</b>	<b>5.747</b>
		<b>Per 20 houses</b>				<b>143.675</b>	<b>143.675</b>
<b>A Investment Amount</b>							
		Year	Unit cost for 4 houses		Unit	Total Amount	
			Financial	Economic		Financial	Economic
		1	118.267	118.267	5	591.335	591.335



**B Investment and Replacement Schedule**

Replacement period for House and Equipment ; 10 year

Year	Construction		Replacement		Total	
	Financial	Economic	Financial	Economic	Financial	Economic
1	591.335	591.335			591.335	591.335
2					0	0.000
3					0	0.000
4					0	0.000
5					0	0.000
6					0	0.000
7					0	0.000
8					0	0.000
9					0	0.000
10					0	0.000
11			591.335	591.335	591.335	591.335
12					0	0.000
13					0	0.000
14					0	0.000
15					0	0.000
16					0	0.000
17					0	0.000
18					0	0.000
19					0	0.000
20					0	0.000
21			591.335	591.335	591.335	591.335
22					0	0.000
23					0	0.000
24					0	0.000
25					0	0.000
26					0	0.000
27					0	0.000
28					0	0.000
29					0	0.000
30					0	0.000

Table A9.3.10 Summary of the Construction Cost

unit : million rials

Description	1st Year		2nd Year		3rd Year		4th Year		5th Year		Total	
	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic
1 Construction Works	6,434.6	6,460.3	6,814.7	6,842.0	7,236.0	7,264.9	303.6	304.8	552.7	554.9	21,341.6	21,401.2
2 Administration	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	312.0	312.0
3 Consulting Services	104.3	104.3	38.4	38.4	38.4	38.4	25.6	25.6	19.2	19.2	225.9	225.9
Sub-total (1-3)	6,601.3	6,627.0	6,915.5	6,942.8	7,336.8	7,365.7	391.6	392.8	634.3	636.5	21,879.5	21,939.1
4 Physical Contingency (7%)	462.1	463.9	484.1	486.0	513.6	515.6	27.4	27.5	44.4	44.6	1,531.6	1,535.8
Sub-total (1-4)	7,063.4	7,090.9	7,399.6	7,428.8	7,850.4	7,881.3	419.0	420.3	678.7	681.1	23,411.1	23,474.9
5 Economic Contingency ( 5 %)	353.2	0.0	370.0	0.0	392.5	0.0	21.0	0.0	33.9	0.0	1,170.6	0.0
Total (1-5)	7,416.6	7,090.9	7,769.6	7,428.8	8,242.9	7,881.3	440.0	420.3	712.6	681.1	24,581.7	23,474.9

Table A9.3.11 Annual Costs of Irrigation and Drainage Facilities

Costs of Construction and Replacement

- (1) Construction cost, refer to
- (2) Replacement cost, 25 years

Year	Construction & Replacement		Recurrent cost		Total cost		Irrigable Area	
	Financial	Economic	Financial	Economic	Financial	Economic	(ha)	%
1	7,416.6	7,090.9	48.2	48.2	7,464.8	7,139.1	1,400.0	46.1
2	7,769.6	7,428.8	67.5	67.5	7,837.1	7,496.3	1,646.0	54.1
3	8,242.9	7,881.3	79.4	79.4	8,322.3	7,960.7	2,014.0	66.3
4	440.0	420.3	97.1	97.1	537.1	517.4	2,382.0	78.4
5	712.6	681.1	114.9	114.9	827.5	796.0	3,040.0	100.0
6			146.6	146.6	146.6	146.6		
7			146.6	146.6	146.6	146.6		
8			146.6	146.6	146.6	146.6		
9			146.6	146.6	146.6	146.6		
10			146.6	146.6	146.6	146.6		
11			146.6	146.6	146.6	146.6		
12			146.6	146.6	146.6	146.6		
13			146.6	146.6	146.6	146.6		
14			146.6	146.6	146.6	146.6		
15			146.6	146.6	146.6	146.6		
16			146.6	146.6	146.6	146.6		
17			146.6	146.6	146.6	146.6		
18			146.6	146.6	146.6	146.6		
19			146.6	146.6	146.6	146.6		
20			146.6	146.6	146.6	146.6		
21			146.6	146.6	146.6	146.6		
22			146.6	146.6	146.6	146.6		
23			146.6	146.6	146.6	146.6		
24			146.6	146.6	146.6	146.6		
25			146.6	146.6	146.6	146.6		
26	7,416.6	7,090.9	146.6	146.6	7,563.1	7,237.5		
27	7,769.6	7,428.8	146.6	146.6	7,916.2	7,575.3		
28	8,242.9	7,881.3	146.6	146.6	8,389.5	8,027.9		
29	440.0	420.3	146.6	146.6	586.6	566.9		
30	712.6	681.1	146.6	146.6	859.2	827.7		

**Table A9.3.12 Machinery for Cultivation of Pasture Plants**

1 set of machinery is required for 280ha of pasture cultivation.

**1. Necessary machinery and cost**

Name	Specification	Unit Price (Million Rls.)	
		Financial	Economic
Tractor	75 Ps, Massy Ferguson	57.5	58.1
	75 Ps, Massy Ferguson	57.5	58.1
Baler	John Deer,	38.5	38.9
Disc harrow	3-wheeled and with 32 blade	8.5	8.6
Trailer	Loading capacity; 5 tons, unloading 2 sides, 4 wheel	12.5	12.6
Broadcaster	for spreading seeds and fertilizer, centrifugal spreading	2.5	2.5
Seeder	for spreading seeds and fertilizer, wheel type	6.5	6.6
Rake	linear	3.2	3.2
Mower	Disc-type	3.2	3.2
Sum		189.9	191.8

Source: Golestan Jihad-e-Agriculture Organization

per ha 0.678 0.685

**2. Introduction and Replacement Schedule**

Replacement; 10 years

Year	Unit cost		Nos. of unit Total area	Required units	Amount	
	Financial	Economic			Financial	Economic
1	189.9	191.8	1,400.0	5	949.5	959.0
2	189.9	191.8	1,646.0	1	189.9	191.8
3	189.9	191.8	2,014.0	2	379.8	383.6
4	189.9	191.8	2,382.0	1	189.9	191.8
5	189.9	191.8	3,040.0	2	379.8	383.6
6						
7						
8						
9						
10						
11					949.5	959.0
12					189.9	191.8
13					379.8	383.6
14					189.9	191.8
15					379.8	383.6
16						
17						
18						
19						
20						
21					949.5	959.0
22					189.9	191.8
23					379.8	383.6
24					189.9	191.8
25					379.8	383.6
26						
27						
28						
29						
30						

**Table A9.3.13 Annual cost of RPC Strengthen Program**

Year	Personnel	Veh & Equip	O & M	Training	Total
1	141.600	198.000	3.485	0.444	343.529
2	141.600		3.485	0.444	145.529
3	141.600		3.485	0.444	145.529
4	141.600		3.485	0.444	145.529
5	141.600		3.485	0.444	145.529
6	141.600		3.485	0.874	145.959
7	141.600		3.485	0.874	145.959
8	141.600		3.485	0.874	145.959
9	141.600		3.485	0.874	145.959
10	141.600		3.485	0.874	145.959
11	141.600	198.000	3.485	0.174	343.259
12	141.600		3.485	0.174	145.259
13	141.600		3.485	0.174	145.259
14	141.600		3.485	0.174	145.259
15	141.600		3.485	0.174	145.259
16	141.600		3.485	0.174	145.259
17	141.600		3.485	0.174	145.259
18	141.600		3.485	0.174	145.259
19	141.600		3.485	0.174	145.259
20	141.600		3.485	0.174	145.259
21	141.600	198.000	3.485	0.174	343.259
22	141.600		3.485	0.174	145.259
23	141.600		3.485	0.174	145.259
24	141.600		3.485	0.174	145.259
25	141.600		3.485	0.174	145.259
26	141.600		3.485	0.174	145.259
27	141.600		3.485	0.174	145.259
28	141.600		3.485	0.174	145.259
29	141.600		3.485	0.174	145.259
30	141.600		3.485	0.174	145.259

**Table A9.3.14 Cost Breakdown for RPC Pavand Strengthening Plan**

**Phase I (5 years)**

<b>Human resources</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit price (Rls.)/year</b>	<b>Price (Rls.)</b>	<b>Remarks</b>
RPC President	M/M	60.0	87,000,000	87,000,000	
Accountant	M/M	60.0	60,000,000	60,000,000	
Tractor operator	M/M	120.0	48,000,000	96,000,000	
Guardzman	M/M	60.0	45,000,000	45,000,000	
Agronomist	M/M	120.0	60,000,000	120,000,000	
Irrigation and drainage engineer	M/M	60.0	60,000,000	60,000,000	
Person in charge of animal husbandry	M/M	60.0	60,000,000	60,000,000	
Person in charge of mechanization	M/M	60.0	60,000,000	60,000,000	
Person in charge of collective	M/M	60.0	60,000,000	60,000,000	
Person in charge of marketing	M/M	60.0	60,000,000	60,000,000	
<b>Total</b>				<b>708,000,000</b>	
<b>Annual cost</b>				<b>141,600,000</b>	

<b>Equipment</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit price (Rls.)</b>	<b>Price (Rls.)</b>	<b>Remarks</b>
Fax machine	Machine	1	4,000,000	4,000,000	
Photocopy machine	Machine	1	18,000,000	18,000,000	
<b>Total</b>				<b>22,000,000</b>	

<b>Vehicles for transport</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit price (Rls.)</b>	<b>Price (Rls.)</b>	<b>Remarks</b>
Pickup truck	Truck	2	80,000,000	160,000,000	
Motor bikes	Bike	4	4,000,000	16,000,000	
<b>Total</b>				<b>176,000,000</b>	
<b>Vehicle &amp; Equipment</b>				<b>198,000,000</b>	

<b>O&amp;M cost</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit price (Rls.)</b>	<b>Price (Rls.)/year</b>	<b>Remarks</b>
Maintenance cost for pickup trucks	-	5%/year	4,000,000	8,000,000	
Maintenance cost for motor bikes	-	5%/year	200,000	800,000	
Operation cost for pickup trucks (gasoline)	litter	18.75L/day/t ruck	500	5,625,000	
Operation cost for motor bikes	litter	5L/day/ bike	500	3,000,000	
<b>Total</b>				<b>17,425,000</b>	
<b>Annual cost</b>				<b>3,485,000</b>	

**Training on participatory methods**

Items	Unit	Quantity	Unit price (J)/month	Price (J)	Remarks
JICA short-term expert	M/M	3.0	3,000,000	9,000,000	Paid by JICA, 1 week for training, the rest for monitoring and consulting Paid by JICA as equipment accompanied by expert dispatch
Training materials (including texts)	-	-	-	100,000	
Items	Unit	Quantity	Unit price (Rls.)	Price (Rls.)	Remarks
Tea, cakes, and fruits	-	-	15,000	150,000	5 days X 2 times (morning and afternoon)

Annual cost

30,000

**Workshops/ General assemblies**

Items	Unit	Quantity	Unit price (Rls.)	Price (Rls.)	Remarks
Tea, cakes, and fruits for workshops	-	-	15,000	720,000	W/S = 2 times/month, Tea break = 2 times/workshop (for 15 persons) GA = 3 times/strengthening function (3), Tea break = Once/general assembly (for 8 areas X 20 persons = 160 persons)
Tea, cakes, and fruits for general assembly	-	-	150,000	1,350,000	

2,070,000

Annual Cost

414,000

**Annual cost of Training & Workshop****444,000****Phase II (5 years)**

Human resources	Unit	Quantity	Unit price (Rls.)/year	Price (Rls.)	Remarks
RPC President	M/M	60.0	87,000,000	87,000,000	
Accountant	M/M	60.0	60,000,000	60,000,000	
Tractor operator	M/M	120.0	48,000,000	96,000,000	
Guardsmen	M/M	60.0	45,000,000	45,000,000	
Agronomist	M/M	120.0	60,000,000	120,000,000	
Irrigation and drainage engineer	M/M	60.0	60,000,000	60,000,000	
Person in charge of animal husbandry	M/M	60.0	60,000,000	60,000,000	
Person in charge of mechanization	M/M	60.0	60,000,000	60,000,000	
Person in charge of collective	M/M	60.0	60,000,000	60,000,000	
Person in charge of marketing	M/M	60.0	60,000,000	60,000,000	

Total

708,000,000

**Annual Cost****141,600,000**

**Financial management**

\* It is not included in the original plan

Items	Unit	Quantity	Unit price (J)/month	Price (J)	Remarks
JICA short-term expert	M/M	3.0	3,000,000	9,000,000	Paid by JICA
Training materials (including texts)	-	-	-	100,000	Paid by JICA as equipment accompanied by expert dispatch
Items	Unit	Quantity	Unit price (Rls.)/time	Price (Rls.)	Remarks
Lecturer from Agricultural Bank	-	-	160,000	7,680,000	Lecture = 4 times/month X 12
Tea, cakes, and fruits	-	-	15,000	1,440,000	Tea break = 2 times/day
Total				9,120,000	
Annual cost				640,000	

**Workshops/ General assemblies**

Items	Unit	Quantity	Unit price (Rls.)	Price (Rls.)	Remarks
Tea, cakes, and fruits for workshops	-	-	15,000	720,000	Workshop: 2 times/month X 12 months, General assembly: 3 times X 1 strengthening W/S = 2 times/month, Tea break = 2
Tea, cakes, and fruits for general assembly	-	-	150,000	450,000	times/workshop (for 15 persons) GA = 3 times/strengthening function (1), Tea break = Once/general assembly (for 8 areas X 20 persons = 160 persons)
Total				1,170,000	
Annual Cost				234,000	

**Annual cost of Training & Workshop**
**874,000**
**Phase III (5 years)**

Human resources	Unit	Quantity	Unit price (Rls.)/year	Price (Rls.)	Remarks
RPC President	M/M	60.0	87,000,000	87,000,000	
Accountant	M/M	60.0	60,000,000	60,000,000	
Tractor operator	M/M	120.0	48,000,000	96,000,000	
Guardman	M/M	60.0	45,000,000	45,000,000	
Agronomist	M/M	120.0	60,000,000	120,000,000	
Irrigation and drainage engineer	M/M	60.0	60,000,000	60,000,000	
Person in charge of animal husbandry	M/M	60.0	60,000,000	60,000,000	
Person in charge of mechanization	M/M	60.0	60,000,000	60,000,000	
Person in charge of collective	M/M	60.0	60,000,000	60,000,000	
Person in charge of marketing	M/M	60.0	60,000,000	60,000,000	
Total				708,000,000	

Annual Cost

141,600,000

Items	Unit	Quantity	Unit price (Rls.)	Price (Rls.)	Remarks
<b>Workshops/ General assemblies</b>					Workshop: 2 times/month X 12 months, General assembly: once for sharing the results 2 times/workshop (for 15 persons)
Tea, cakes, and fruits for workshops	-	-	15,000	720,000	
Tea, cakes, and fruits for general assembly	-	-	150,000	150,000	GA = once for sharing the results of M&E, Tea break = Once/general assembly (for 8 areas X 20 persons = 160 persons)

870,000

Annual Cost

174,000



**Table A9.3.15 Costs in Financial Cost**

Year	Construction	Machinery	G House	Cow	Sub-total	RPC	Total
1	7,464.8	949.5	591.3	4,660.0	13,665.6	343.5	14,009.1
2	7,837.1	189.9	0.0	0.0	8,027.0	145.5	8,172.5
3	8,322.3	379.8	0.0	0.0	8,702.1	145.5	8,847.6
4	537.1	189.9	0.0	16,684.0	17,411.0	145.5	17,556.5
5	827.5	379.8	0.0	0.0	1,207.3	145.5	1,352.8
6	146.6	0.0	0.0	0.0	146.6	146.0	292.5
7	146.6	0.0	0.0	10,434.0	10,580.6	146.0	10,726.5
8	146.6	0.0	0.0	0.0	146.6	146.0	292.5
9	146.6	0.0	0.0	0.0	146.6	146.0	292.5
10	146.6	0.0	0.0	0.0	146.6	146.0	292.5
11	146.6	949.5	591.3	419.0	2,106.4	343.3	2,449.6
12	146.6	189.9	0.0	0.0	336.5	145.3	481.7
13	146.6	379.8	0.0	0.0	526.4	145.3	671.6
14	146.6	189.9	0.0	0.0	336.5	145.3	481.7
15	146.6	379.8	0.0	0.0	526.4	145.3	671.6
16	146.6	0.0	0.0	0.0	146.6	145.3	291.8
17	146.6	0.0	0.0	0.0	146.6	145.3	291.8
18	146.6	0.0	0.0	0.0	146.6	145.3	291.8
19	146.6	0.0	0.0	0.0	146.6	145.3	291.8
20	146.6	0.0	0.0	0.0	146.6	145.3	291.8
21	146.6	949.5	591.3	2,002.7	3,690.1	343.3	4,033.4
22	146.6	189.9	0.0	0.0	336.5	145.3	481.7
23	146.6	379.8	0.0	0.0	526.4	145.3	671.6
24	146.6	189.9	0.0	0.0	336.5	145.3	481.7
25	146.6	379.8	0.0	0.0	526.4	145.3	671.6
26	7,563.1	0.0	0.0	0.0	7,563.1	145.3	7,708.4
27	7,916.2	0.0	0.0	0.0	7,916.2	145.3	8,061.4
28	8,389.5	0.0	0.0	0.0	8,389.5	145.3	8,534.7
29	586.6	0.0	0.0	0.0	586.6	145.3	731.8
30	859.2	0.0	0.0	0.0	859.2	145.3	1,004.4

100,431.8

**Table A9.3.16 Costs in Economic Cost**

Year	Construction	Machinery	G. House	Cow	Sub-total	RPC	Total
1	7,139.1	959.0	591.3	4,660.0	13,349.4	343.5	13,693.0
2	7,496.3	191.8	0.0	0.0	7,688.1	145.5	7,833.6
3	7,960.7	383.6	0.0	0.0	8,344.3	145.5	8,489.8
4	517.4	191.8	0.0	16,684.0	17,393.2	145.5	17,538.7
5	796.0	383.6	0.0	0.0	1,179.6	145.5	1,325.1
6	146.6	0.0	0.0	0.0	146.6	146.0	292.5
7	146.6	0.0	0.0	10,434.0	10,580.6	146.0	10,726.5
8	146.6	0.0	0.0	0.0	146.6	146.0	292.5
9	146.6	0.0	0.0	0.0	146.6	146.0	292.5
10	146.6	0.0	0.0	0.0	146.6	146.0	292.5
11	146.6	959.0	591.3	419.0	2,115.9	343.3	2,459.1
12	146.6	191.8	0.0	0.0	338.4	145.3	483.6
13	146.6	383.6	0.0	0.0	530.2	145.3	675.4
14	146.6	191.8	0.0	0.0	338.4	145.3	483.6
15	146.6	383.6	0.0	0.0	530.2	145.3	675.4
16	146.6	0.0	0.0	0.0	146.6	145.3	291.8
17	146.6	0.0	0.0	0.0	146.6	145.3	291.8
18	146.6	0.0	0.0	0.0	146.6	145.3	291.8
19	146.6	0.0	0.0	0.0	146.6	145.3	291.8
20	146.6	0.0	0.0	0.0	146.6	145.3	291.8
21	146.6	959.0	591.3	2,002.7	3,699.6	343.3	4,042.9
22	146.6	191.8	0.0	0.0	338.4	145.3	483.6
23	146.6	383.6	0.0	0.0	530.2	145.3	675.4
24	146.6	191.8	0.0	0.0	338.4	145.3	483.6
25	146.6	383.6	0.0	0.0	530.2	145.3	675.4
26	7,237.5	0.0	0.0	0.0	7,237.5	145.3	7,382.7
27	7,575.3	0.0	0.0	0.0	7,575.3	145.3	7,720.6
28	8,027.9	0.0	0.0	0.0	8,027.9	145.3	8,173.2
29	566.9	0.0	0.0	0.0	566.9	145.3	712.2
30	827.7	0.0	0.0	0.0	827.7	145.3	972.9

**Table A9.3.18 Financial and Economic Evaluation**  
**Case of 10% Increase of Project Costs**

Financial Cost			
Year	Cost	Benefit	Incremental Benefit
1	15,395.8	-1,515.3	-16,911.1
2	8,975.6	626.0	-8,349.6
3	9,718.1	1,101.4	-8,616.8
4	19,298.0	2,787.7	-16,510.3
5	1,473.9	7,454.6	5,980.8
6	307.5	9,221.2	8,913.6
7	11,784.9	9,221.2	-2,563.8
8	307.5	13,271.5	12,963.9
9	307.5	13,271.5	12,963.9
10	307.5	13,271.5	12,963.9
11	2,680.4	13,271.5	10,591.0
12	515.7	13,271.5	12,755.7
13	724.6	13,271.5	12,546.8
14	515.7	13,271.5	12,755.7
15	724.6	13,271.5	12,546.8
16	306.8	13,271.5	12,964.6
17	306.8	13,271.5	12,964.6
18	306.8	13,271.5	12,964.6
19	306.8	13,271.5	12,964.6
20	306.8	13,271.5	12,964.6
21	4,422.6	13,271.5	8,848.9
22	515.7	13,271.5	12,755.7
23	724.6	13,271.5	12,546.8
24	515.7	13,271.5	12,755.7
25	724.6	13,271.5	12,546.8
26	8,465.1	13,271.5	4,806.4
27	8,853.4	13,271.5	4,418.0
28	9,374.0	13,271.5	3,897.4
29	790.8	13,271.5	12,480.6
30	1,090.7	13,271.5	12,180.7

110,049.2      335,655.6

IRR=            14.8%  
 NPV=          16,290.7  
 B/C=            3.1

Economic Cost			
Year	Cost	Benefit	Incremental Benefit
1	15,048.0	-1,449.3	-16,497.3
2	8,602.7	960.4	-7,642.3
3	9,324.6	2,070.5	-7,254.2
4	19,278.4	3,921.9	-15,356.5
5	1,443.4	9,277.6	7,834.2
6	307.5	11,337.8	11,030.3
7	11,784.9	11,337.8	-447.1
8	307.5	16,186.3	15,878.8
9	307.5	16,186.3	15,878.8
10	307.5	16,186.3	15,878.8
11	2,690.9	16,186.3	13,495.5
12	517.8	16,186.3	15,668.5
13	728.8	16,186.3	15,457.5
14	517.8	16,186.3	15,668.5
15	728.8	16,186.3	15,457.5
16	306.8	16,186.3	15,879.5
17	306.8	16,186.3	15,879.5
18	306.8	16,186.3	15,879.5
19	306.8	16,186.3	15,879.5
20	306.8	16,186.3	15,879.5
21	4,433.0	16,186.3	11,753.3
22	517.8	16,186.3	15,668.5
23	728.8	16,186.3	15,457.5
24	517.8	16,186.3	15,668.5
25	728.8	16,186.3	15,457.5
26	8,106.8	16,186.3	8,079.5
27	8,478.5	16,186.3	7,707.9
28	8,976.3	16,186.3	7,210.0
29	769.2	16,186.3	15,417.1
30	1,056.1	16,186.3	15,130.3

107,743.8      411,191.8

IRR=            18.7%  
 NPV=          26,904.1  
 B/C=            3.8

**Table A9.3.18 Financial and Economic Evaluation**  
**Case of 10% Increase of Project Costs**

Financial Cost			
Year	Cost	Benefit	Incremental Benefit
1	15,395.8	-1,515.3	-16,911.1
2	8,975.6	626.0	-8,349.6
3	9,718.1	1,101.4	-8,616.8
4	19,298.0	2,787.7	-16,510.3
5	1,473.9	7,454.6	5,980.8
6	307.5	9,221.2	8,913.6
7	11,784.9	9,221.2	-2,563.8
8	307.5	13,271.5	12,963.9
9	307.5	13,271.5	12,963.9
10	307.5	13,271.5	12,963.9
11	2,680.4	13,271.5	10,591.0
12	515.7	13,271.5	12,755.7
13	724.6	13,271.5	12,546.8
14	515.7	13,271.5	12,755.7
15	724.6	13,271.5	12,546.8
16	306.8	13,271.5	12,964.6
17	306.8	13,271.5	12,964.6
18	306.8	13,271.5	12,964.6
19	306.8	13,271.5	12,964.6
20	306.8	13,271.5	12,964.6
21	4,422.6	13,271.5	8,848.9
22	515.7	13,271.5	12,755.7
23	724.6	13,271.5	12,546.8
24	515.7	13,271.5	12,755.7
25	724.6	13,271.5	12,546.8
26	8,465.1	13,271.5	4,806.4
27	8,853.4	13,271.5	4,418.0
28	9,374.0	13,271.5	3,897.4
29	790.8	13,271.5	12,480.6
30	1,090.7	13,271.5	12,180.7

110,049.2      335,655.6

IRR=            14.8%  
 NPV=           16,290.7  
 B/C=             3.1

Economic Cost			
Year	Cost	Benefit	Incremental Benefit
1	15,048.0	-1,449.3	-16,497.3
2	8,602.7	960.4	-7,642.3
3	9,324.6	2,070.5	-7,254.2
4	19,278.4	3,921.9	-15,356.5
5	1,443.4	9,277.6	7,834.2
6	307.5	11,337.8	11,030.3
7	11,784.9	11,337.8	-447.1
8	307.5	16,186.3	15,878.8
9	307.5	16,186.3	15,878.8
10	307.5	16,186.3	15,878.8
11	2,690.9	16,186.3	13,495.5
12	517.8	16,186.3	15,668.5
13	728.8	16,186.3	15,457.5
14	517.8	16,186.3	15,668.5
15	728.8	16,186.3	15,457.5
16	306.8	16,186.3	15,879.5
17	306.8	16,186.3	15,879.5
18	306.8	16,186.3	15,879.5
19	306.8	16,186.3	15,879.5
20	306.8	16,186.3	15,879.5
21	4,433.0	16,186.3	11,753.3
22	517.8	16,186.3	15,668.5
23	728.8	16,186.3	15,457.5
24	517.8	16,186.3	15,668.5
25	728.8	16,186.3	15,457.5
26	8,106.8	16,186.3	8,079.5
27	8,478.5	16,186.3	7,707.9
28	8,976.3	16,186.3	7,210.0
29	769.2	16,186.3	15,417.1
30	1,056.1	16,186.3	15,130.3

107,743.8      411,191.8

IRR=            18.7%  
 NPV=           26,904.1  
 B/C=             3.8

**Table A9.3.19 Summary of Finacial Cost  
In Case10% Increase of Project Cost**

Year	Costruction	Machinsery	Green House	Cow	Sub-total	RPC	Total
1	8,211.3	1,044.5	650.5	5,126.0	15,032.1	363.7	15,395.8
2	8,620.8	208.9	0.0	0.0	8,829.7	145.9	8,975.6
3	9,154.5	417.8	0.0	0.0	9,572.3	145.9	9,718.1
4	590.8	208.9	0.0	18,352.4	19,152.1	145.9	19,298.0
5	910.2	417.8	0.0	0.0	1,328.0	145.9	1,473.9
6	161.2	0.0	0.0	0.0	161.2	146.3	307.5
7	161.2	0.0	0.0	11,477.4	11,638.6	146.3	11,784.9
8	161.2	0.0	0.0	0.0	161.2	146.3	307.5
9	161.2	0.0	0.0	0.0	161.2	146.3	307.5
10	161.2	0.0	0.0	0.0	161.2	146.3	307.5
11	161.2	1,044.5	650.5	460.8	2,317.0	363.4	2,680.4
12	161.2	208.9	0.0	0.0	370.1	145.6	515.7
13	161.2	417.8	0.0	0.0	579.0	145.6	724.6
14	161.2	208.9	0.0	0.0	370.1	145.6	515.7
15	161.2	417.8	0.0	0.0	579.0	145.6	724.6
16	161.2	0.0	0.0	0.0	161.2	145.6	306.8
17	161.2	0.0	0.0	0.0	161.2	145.6	306.8
18	161.2	0.0	0.0	0.0	161.2	145.6	306.8
19	161.2	0.0	0.0	0.0	161.2	145.6	306.8
20	161.2	0.0	0.0	0.0	161.2	145.6	306.8
21	161.2	1,044.5	650.5	2,203.0	4,059.2	363.4	4,422.6
22	161.2	208.9	0.0	0.0	370.1	145.6	515.7
23	161.2	417.8	0.0	0.0	579.0	145.6	724.6
24	161.2	208.9	0.0	0.0	370.1	145.6	515.7
25	161.2	417.8	0.0	0.0	579.0	145.6	724.6
26	8,319.5	0.0	0.0	0.0	8,319.5	145.6	8,465.1
27	8,707.8	0.0	0.0	0.0	8,707.8	145.6	8,853.4
28	9,228.4	0.0	0.0	0.0	9,228.4	145.6	9,374.0
29	645.2	0.0	0.0	0.0	645.2	145.6	790.8
30	945.1	0.0	0.0	0.0	945.1	145.6	1,090.7

**Table A9.3.20 Summary of Economic Cost  
In Case of 10% Increases of Project Cost**

Year	Costruction	Machinery	Green House	Cow	Sub-otal	RPC	Total
1	7,853.0	1,054.9	650.5	5,126.0	14,684.4	363.7	15,048.0
2	8,245.9	211.0	0.0	0.0	8,456.9	145.9	8,602.7
3	8,756.8	422.0	0.0	0.0	9,178.7	145.9	9,324.6
4	569.2	211.0	0.0	18,352.4	19,132.5	145.9	19,278.4
5	875.6	422.0	0.0	0.0	1,297.5	145.9	1,443.4
6	161.2	0.0	0.0	0.0	161.2	146.3	307.5
7	161.2	0.0	0.0	11,477.4	11,638.6	146.3	11,784.9
8	161.2	0.0	0.0	0.0	161.2	146.3	307.5
9	161.2	0.0	0.0	0.0	161.2	146.3	307.5
10	161.2	0.0	0.0	0.0	161.2	146.3	307.5
11	161.2	1,054.9	650.5	460.8	2,327.4	363.4	2,690.9
12	161.2	211.0	0.0	0.0	372.2	145.6	517.8
13	161.2	422.0	0.0	0.0	583.2	145.6	728.8
14	161.2	211.0	0.0	0.0	372.2	145.6	517.8
15	161.2	422.0	0.0	0.0	583.2	145.6	728.8
16	161.2	0.0	0.0	0.0	161.2	145.6	306.8
17	161.2	0.0	0.0	0.0	161.2	145.6	306.8
18	161.2	0.0	0.0	0.0	161.2	145.6	306.8
19	161.2	0.0	0.0	0.0	161.2	145.6	306.8
20	161.2	0.0	0.0	0.0	161.2	145.6	306.8
21	161.2	1,054.9	650.5	2,203.0	4,069.6	363.4	4,433.0
22	161.2	211.0	0.0	0.0	372.2	145.6	517.8
23	161.2	422.0	0.0	0.0	583.2	145.6	728.8
24	161.2	211.0	0.0	0.0	372.2	145.6	517.8
25	161.2	422.0	0.0	0.0	583.2	145.6	728.8
26	7,961.2	0.0	0.0	0.0	7,961.2	145.6	8,106.8
27	8,332.9	0.0	0.0	0.0	8,332.9	145.6	8,478.5
28	8,830.7	0.0	0.0	0.0	8,830.7	145.6	8,976.3
29	623.6	0.0	0.0	0.0	623.6	145.6	769.2
30	910.5	0.0	0.0	0.0	910.5	145.6	1,056.1

107,743.8

**Table A9.3.21 Annual Costs of Irrigation and Drainage Facilities**  
**Case of 10% Increase of Project Cost**

Year	Construction & Replacement		Recurrent cost		Total cost		Irrigable Area	
	Financial	Economic	Financial	Economic	Financial	Economic	(ha)	%
1	7,416.6	7,090.9	48.2	48.2	7,464.8	7,139.1	1,400.0	46.1
2	7,769.6	7,428.8	67.5	67.5	7,837.1	7,496.3	1,646.0	54.1
3	8,242.9	7,881.3	79.4	79.4	8,322.3	7,960.7	2,014.0	66.3
4	440.0	420.3	97.1	97.1	537.1	517.4	2,382.0	78.4
5	712.6	681.1	114.9	114.9	827.5	796.0	3,040.0	100.0
6			146.6	146.6	146.6	146.6		
7			146.6	146.6	146.6	146.6		
8			146.6	146.6	146.6	146.6		
9			146.6	146.6	146.6	146.6		
10			146.6	146.6	146.6	146.6		
11			146.6	146.6	146.6	146.6		
12			146.6	146.6	146.6	146.6		
13			146.6	146.6	146.6	146.6		
14			146.6	146.6	146.6	146.6		
15			146.6	146.6	146.6	146.6		
16			146.6	146.6	146.6	146.6		
17			146.6	146.6	146.6	146.6		
18			146.6	146.6	146.6	146.6		
19			146.6	146.6	146.6	146.6		
20			146.6	146.6	146.6	146.6		
21			146.6	146.6	146.6	146.6		
22			146.6	146.6	146.6	146.6		
23			146.6	146.6	146.6	146.6		
24			146.6	146.6	146.6	146.6		
25			146.6	146.6	146.6	146.6		
26	7,416.6	7,090.9	146.6	146.6	7,563.1	7,237.5		
27	7,769.6	7,428.8	146.6	146.6	7,916.2	7,575.3		
28	8,242.9	7,881.3	146.6	146.6	8,389.5	8,027.9		
29	440.0	420.3	146.6	146.6	586.6	566.9		
30	712.6	681.1	146.6	146.6	859.2	827.7		

**Table A9.3.22 Annual cost of RPC Strengthen Program**  
**Case of 10% Increase of Project Cost**  
**Vehicles, Equipment and O/M cost are increased**

Year	Personnel	Veh & Equip	O & M	Training	Total
1	141.600	217.800	3.834	0.444	363.678
2	141.600		3.834	0.444	145.878
3	141.600		3.834	0.444	145.878
4	141.600		3.834	0.444	145.878
5	141.600		3.834	0.444	145.878
6	141.600		3.834	0.874	146.308
7	141.600		3.834	0.874	146.308
8	141.600		3.834	0.874	146.308
9	141.600		3.834	0.874	146.308
10	141.600		3.834	0.874	146.308
11	141.600	217.800	3.834	0.174	363.408
12	141.600		3.834	0.174	145.608
13	141.600		3.834	0.174	145.608
14	141.600		3.834	0.174	145.608
15	141.600		3.834	0.174	145.608
16	141.600		3.834	0.174	145.608
17	141.600		3.834	0.174	145.608
18	141.600		3.834	0.174	145.608
19	141.600		3.834	0.174	145.608
20	141.600		3.834	0.174	145.608
21	141.600	217.800	3.834	0.174	363.408
22	141.600		3.834	0.174	145.608
23	141.600		3.834	0.174	145.608
24	141.600		3.834	0.174	145.608
25	141.600		3.834	0.174	145.608
26	141.600		3.834	0.174	145.608
27	141.600		3.834	0.174	145.608
28	141.600		3.834	0.174	145.608
29	141.600		3.834	0.174	145.608
30	141.600		3.834	0.174	145.608



**Table A9.3.23 Financial and Economic Evaluation**  
**Case of 10% Decrease of Agricultural Products Prices**

Financial Cost				Economic Cost			
Year	Cost	Benefit	Incremental Benefit	Year	Cost	Benefit	Incremental Benefit
1	14,009.1	-1,789.1	-15,798.3	1	13,693.0	-1,725.1	-15,418.0
2	8,172.5	39.8	-8,132.8	2	7,833.6	231.6	-7,602.0
3	8,847.6	223.9	-8,623.7	3	8,489.8	1,049.6	-7,440.3
4	17,556.5	1,646.0	-15,910.5	4	17,538.7	2,635.8	-14,903.0
5	1,352.8	6,025.7	4,672.9	5	1,325.1	7,506.1	6,181.0
6	292.5	7,538.4	7,245.9	6	292.5	9,356.9	9,064.4
7	10,726.5	7,538.4	-3,188.1	7	10,726.5	9,356.9	-1,369.6
8	292.5	11,084.5	10,791.9	8	292.5	13,141.0	12,848.4
9	292.5	11,085.6	10,793.0	9	292.5	13,141.0	12,848.4
10	292.5	11,085.6	10,793.0	10	292.5	13,141.0	12,848.4
11	2,449.6	11,085.6	8,636.0	11	2,459.1	13,141.0	10,681.9
12	481.7	11,085.6	10,603.8	12	483.6	13,141.0	12,657.3
13	671.6	11,085.6	10,413.9	13	675.4	13,141.0	12,465.5
14	481.7	11,085.6	10,603.8	14	483.6	13,141.0	12,657.3
15	671.6	11,085.6	10,413.9	15	675.4	13,141.0	12,465.5
16	291.8	11,085.6	10,793.7	16	291.8	13,141.0	12,849.1
17	291.8	11,085.6	10,793.7	17	291.8	13,141.0	12,849.1
18	291.8	11,085.6	10,793.7	18	291.8	13,141.0	12,849.1
19	291.8	11,085.6	10,793.7	19	291.8	13,141.0	12,849.1
20	291.8	11,085.6	10,793.7	20	291.8	13,141.0	12,849.1
21	4,033.4	11,085.6	7,052.2	21	4,042.9	13,141.0	9,098.1
22	481.7	11,085.6	10,603.8	22	483.6	13,141.0	12,657.3
23	671.6	11,085.6	10,413.9	23	675.4	13,141.0	12,465.5
24	481.7	11,085.6	10,603.8	24	483.6	13,141.0	12,657.3
25	671.6	11,085.6	10,413.9	25	675.4	13,141.0	12,465.5
26	7,708.4	11,085.6	3,377.2	26	7,382.7	13,141.0	5,758.2
27	8,061.4	11,085.6	3,024.1	27	7,720.6	13,141.0	5,420.4
28	8,534.7	11,085.6	2,550.8	28	8,173.2	13,141.0	4,967.8
29	731.8	11,085.6	10,353.7	29	712.2	13,141.0	12,428.8
30	1,004.4	11,085.6	10,081.1	30	972.9	13,141.0	12,168.0
100,431.8		277,979.5		98,336.0		332,379.4	

IRR= 12.9%  
 NPV= 7,539.4  
 B/C= 2.8

IRR= 16.2%  
 NPV= 20,825.1  
 B/C= 3.4

**Table A9.3.24 Benefit in Financial Cost**  
**Case of 10% Decrease of Agricultural Products Prices**

Year	With Project (Million Rials)						Without		Project	Balance	
	Area	Crops per ha	Total	G. House 20 houses	per farmer	Cow Farmer	Total	Total Amount			
1	2004	1,000.00	1.151	1,151.375	0.000	0.000	0	0.0	1,151.4	2,940.508	(1,789.1)
2	2005	1,400.00	1.280	1,791.475	113.675	18.862	57	1,075.1	2,980.3	2,940.508	39.8
3	2006	1,646.00	1.200	1,975.612	113.675	18.862	57	1,075.1	3,164.4	2,940.508	223.9
4	2007	2,014.00	1.687	3,397.694	113.675	18.862	57	1,075.1	4,586.5	2,940.508	1,646.0
5	2008	2,382.00	2.299	5,476.218	113.675	18.862	179	3,376.3	8,966.2	2,940.508	6,025.7
6	2009	3,040.00	2.299	6,988.960	113.675	18.862	179	3,376.3	10,478.9	2,940.508	7,538.4
7	2010	3,040.00	2.299	6,988.960	113.675	18.862	179	3,376.3	10,478.9	2,940.508	7,538.4
8	2011	3,040.00	2.299	6,988.960	113.675	18.862	367	6,922.4	14,025.0	2,940.508	11,084.5
9	2012	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
10	2013	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
11	2014	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
12	2015	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
13	2016	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
14	2017	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
15	2018	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
16	2019	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
17	2020	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
18	2021	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
19	2022	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
20	2023	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
21	2024	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
22	2025	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
23	2026	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
24	2027	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
25	2028	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
26	2029	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
27	2030	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
28	2031	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
29	2032	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6
30	2033	3,040.00	2.299	6,988.960	113.675	18.865	367	6,923.5	14,026.1	2,940.508	11,085.6

**Table A9.3.25 Benefit in Economic Cost  
Case of 10% Decrease of Agricultural Products Prices**

		With Project (Million Rials)						Without			
Year		Crops			G. House	Cow		Total	Project	Balance	
		Area	per ha	Total	20 houses	per farmer	Farmer	Total			Amount
1	2004	1,000.00	1.215	1,215.425	0.000	0.000	0	0.000	1,215.4	2,940.508	(1,725.1)
2	2005	1,400.00	1.344	1,881.145	143.675	20.128	57	1,147.296	3,172.1	2,940.508	231.6
3	2006	1,646.00	1.640	2,699.119	143.675	20.128	57	1,147.296	3,990.1	2,940.508	1,049.6
4	2007	2,014.00	2.128	4,285.314	143.675	20.128	57	1,147.296	5,576.3	2,940.508	2,635.8
5	2008	2,382.00	2.813	6,700.030	143.675	20.128	179	3,602.912	10,446.6	2,940.508	7,506.1
6	2009	3,040.00	2.813	8,550.836	143.675	20.128	179	3,602.912	12,297.4	2,940.508	9,356.9
7	2010	3,040.00	2.813	8,550.836	143.675	20.128	179	3,602.912	12,297.4	2,940.508	9,356.9
8	2011	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
9	2012	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
10	2013	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
11	2014	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
12	2015	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
13	2016	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
14	2017	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
15	2018	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
16	2019	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
17	2020	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
18	2021	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
19	2022	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
20	2023	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
21	2024	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
22	2025	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
23	2026	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
24	2027	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
25	2028	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
26	2029	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
27	2030	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
28	2031	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
29	2032	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0
30	2033	3,040.00	2.813	8,550.836	143.675	20.128	367	7,386.976	16,081.5	2,940.508	13,141.0

**Table A9.3.26 Benefit in Initial Stage**  
**Case of 10% Decrease of Agricultural Products Prices**

	Year	Wheat		Rape		Grass		Pea		Cotton		Total net income			
		Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	per 4ha		per ha	
												Financial	Economic	Financial	Economic
Yield	1	3.0	3.0	2.0	2.0	0.0	0.0	0.0	0.0	1.3	1.3				
	2	3.0	3.0	2.0	2.0	0.0	0.0	0.0	0.0	1.5	1.5				
	3	3.3	3.3	2.2	2.2	3.0	3.0	1.0	1.0	1.6	1.6				
	4	3.5	3.5	2.4	2.4	3.5	3.5	1.3	1.3	1.8	1.8				
	5	4.0	4.0	2.5	2.5	4.0	4.0	1.5	1.5	2.0	2.0				
Producer Unit Price (Rials		945.0	968.4	1,845.0	1,845.0	742.5	742.5	1,683.0	1,683.0	2,565.0	2,565.0				
Gross Income (Million Rials)	1	2.835	2.905	3.690	3.690	0.000	0.000	0.000	0.000	3.335	3.335	9.860	9.930		
	2	2.835	2.905	3.690	3.690	0.000	0.000	0.000	0.000	3.848	3.848	10.373	10.443		
	3	3.119	3.196	4.059	4.059	2.228	2.228	1.683	1.683	4.104	4.104	15.192	15.269		
	4	3.308	3.389	4.428	4.428	2.599	2.599	2.188	2.188	4.617	4.617	17.139	17.221		
	5	3.780	3.874	4.613	4.613	2.970	2.970	2.525	2.525	5.130	5.130	19.017	19.111		
Production Cost Million Rials	1	1.110	0.999	1.214	1.139	0.000	0.000	0.000	0.000	2.930	2.930	5.254	5.068		
	2	1.110	0.999	1.214	1.139	0.000	0.000	0.000	0.000	2.930	2.930	5.254	5.068		
	3	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
	4	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
	5	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
Net Income Million Rials	1	1.725	1.906	2.476	2.551	0.000	0.000	0.000	0.000	0.405	0.405	4.606	4.862	1.151	1.215
	2	1.725	1.906	2.476	2.551	0.000	0.000	0.000	0.000	0.918	0.918	5.119	5.375	1.280	1.344
	3	2.009	2.197	2.845	2.920	0.863	1.164	-0.106	0.195	-0.809	0.084	4.801	6.559	1.200	1.640
	4	2.198	2.390	3.214	3.289	1.234	1.535	0.399	0.700	-0.296	0.597	6.748	8.511	1.687	2.128
	5	2.670	2.875	3.399	3.474	1.605	1.906	0.736	1.317	0.787	1.680	9.196	11.251	2.299	2.813

**Table A9.3.27 Benefit of Hybrid Cow  
Case of 10% Decrease of Agricultural Products Prices**

No.	Items	Unit price		Quantity	Amount	
		Financial	Economic		Financial	Economic
		Rls		m2	Million Rls.	
1	Investment					
1)	Buildings					
	Mother cow stall	170,000	170,000.0	40.0	6.800	6.800
	Female cow (2 years old) stall	170,000	170,000.0	10.0	1.700	1.700
	Cow (1 year old) stall	170,000	170,000.0	10.0	1.700	1.700
	Calves stall	230,000	230,000.0	8.0	1.840	1.840
	Storage room of concentrate feed	250,000	250,000.0	12.0	3.000	3.000
	Paddock	43,000	43,000.0	80.0	3.440	3.440
	Feeder	924,000	924,000.0	1.0	0.924	0.924
	<b>Sum</b>				<b>19.404</b>	<b>19.404</b>
2)	Facilities			unit		
	Milker	3,000,000	3,000,000.0	1.0	3.000	3.000
	Sterilizer	3,500,000	3,500,000.0	1.0	3.500	3.500
	Milk-storage tank	500,000	500,000.0	1.0	0.500	0.500
	Others	350,000	350,000.0	1.0	0.350	0.350
	<b>Sum</b>				<b>7.350</b>	<b>7.350</b>
	<b>Total of Building and Equip</b>				<b>26.754</b>	<b>26.754</b>
3)	Purchase of 10 heads cows	5,500,000	5,500,000.0	10.0	55.000	<b>55.000</b>
	<b>Total</b>				<b>81.754</b>	<b>81.754</b>
2	Annual running cost					
	Medicines, sanitary goods, vaccines	1,250,000	1,250,000.0	1.0	1.250	1.250
	Charges of water and electricity	500,000	500,000.0	1.0	0.500	0.500
	Fuel charge	500,000	500,000.0	1.0	0.500	0.500
	Concentrate feed kg	860	860.0	15,000.0	12.900	12.900
	Hay kg	300	300.0	25,000.0	7.500	7.500
	Others	680,000	680,000.0	1.0	0.680	0.680
	<b>Sum</b>				<b>23.330</b>	<b>23.330</b>
3	Annual total cost					
	Depreciation of building	776,000	0.0	1.0	0.776	0.000
	Depreciation of facilities	490,000	0.0	1.0	0.490	0.000
	Running cost	23,330,000	23,330,000.0	1.0	23.330	23.330
	<b>Sum</b>				<b>24.596</b>	<b>23.330</b>
4	Annual gross income					
	Sale of milk	1,341	1,490.0	18,000.0	24.138	24.138
	Sale of bull (1 year old)	2,500,000	2,500,000.0	4.0	10.000	10.000
	Sale of cow (over 2 years old)	3,000,000	3,000,000.0	4.0	12.000	12.000
	Sale of manure (ton)	15,000	15,000.0	20.0	0.300	0.300
	<b>Sum</b>				<b>46.438</b>	<b>46.438</b>
5	Balance				<b>21.842</b>	<b>23.108</b>

**A Existing Condition of Cow breeding**

There is no available data of the actual numbers of cows in the area, the estimation is made as following manner;

Based on the results of the hearing, half to the farmers of the area have two to ten cows.

If half of the 375 framers in the cad aster have 5 cows, 940 cows ( 375/2 x 5=938) are breaded

The milk production of each cow is annually 800 litter, and the sales price per litter is 1,49

Thus, the benefit of the each farmer in the present condition is as follows;

$$800 \times 1,490 \times 5 = 5.96 \text{ Million rials/farmer}$$

**B Cow introduction schedule**

Year	Nos. of Farmers		
1	57	farmers (land tenure over 10ha)	16%
2			
3			

4	122	farmers (land tenure between 5ha to 10ha) 33%
5		
6		
7	188	farmers (land tenure less than 5ha) 51%

C The milk production will start one year after of the introduction of cows, and the increment of the benefit between present condition and with project is ;

Half of farmer will change traditional variety to Hybrid cow.

Therefore, net income is calculated as following manner.

Financial  $\{21.842 + (21.842 - 5.96)\} / 2 = 18.862$  Million rials

Economic  $\{23.108 + (23.108 - 5.96)\} / 2 = 20.128$  Million Rials

#### Benefit Increment

Year	Increment Benefit				
	Unit amount		Quantity	Amount	
	Financial	Economic		Financial	Economic
1	0	0	0	0.000	0.000
2	18.862	20.128	57	1,075.134	1,147.296
3	18.862	20.128	57	1,075.134	1,147.296
4	18.862	20.128	57	1,075.134	1,147.296
5	18.862	20.128	179	3,376.298	3,602.912
6	18.862	20.128	179	3,376.298	3,602.912
7	18.862	20.128	179	3,376.298	3,602.912
8	18.862	20.128	367	6,922.354	7,386.976
9	18.862	20.128	367	6,922.354	7,386.976

**Table A9.3.28 Benefit of Platic Green House**  
**Case of 10% Decrease of Agricultural Products Prices**

No. Items	Unit price		Quantity	Amount		
	Financial Rls	Economic		Financial Million Rls.	Economic	
<b>1 Investment</b>						
1) Construction and facilities of green house						
Frame pipe	4x500m2	25,000	25,000	2000	50.000	50.000
Heater		5,000,000	5,000,000	4	20.000	20.000
Ventilator		400,000	400,000	8	3.200	3.200
Irrigation facilities	m2	7,500	7,500	2,000	15.000	15.000
water tank		2,000,000	2,000,000	1	2.000	2.000
Plastic film	m2	1,000	1,000	5,000	5.000	5.000
Generator		5,000,000	5,000,000	1	5.000	5.000
Guard and resting house		5,400,000	5,400,000	1	5.400	5.400
Others		5,288,000	5,288,000	1	5.288	5.288
Sum					<b>110.888</b>	110.888
2) Equipments and implements						
Sprayer		3,000,000	3,000,000	1	3.000	3.000
Thermometer		70,000	70,000	4	0.280	0.280
Thermometer in soil		100,000	100,000	4	0.400	0.400
Hygrometer		7,000	7,000	4	0.028	0.028
Scissors with long grips		80,000	80,000	4	0.320	0.320
Scissors with short grips		20,000	20,000	4	0.080	0.080
Ordinary scissors		75,000	75,000	4	0.300	0.300
Hoe		20,000	20,000	4	0.080	0.080
Trowel		4,000	4,000	10	0.040	0.040
Handcart		150,000	150,000	2	0.300	0.300
Lighting facilities		2,000,000	2,000,000	1	2.000	2.000
Rake		7,000	7,000	4	0.028	0.028
Thermostat		40,000	40,000	4	0.160	0.160
Others		363,000	363,000	1	0.363	0.363
Sum					<b>7.379</b>	<b>7.379</b>
<b>Grand Total</b>					<b>118.267</b>	<b>118.267</b>
<b>Investment cost per 1 unit (500m2)</b>					<b>29.567</b>	<b>29.567</b>
<b>3 Running cost (2 times cultivation during a year)</b>						
Liquid fertilizer		0.400	0.400	1	0.400	0.400
Chemical fertilizer		0.200	0.200	1	0.200	0.200
Manure		0.200	0.200	1	0.200	0.200
String		0.240	0.240	1	0.240	0.240
Chemicals		0.500	0.500	1	0.500	0.500
Packing materials		3.000	3.000	1	3.000	3.000
Fuel		5.400	5.400	1	5.400	5.400
Electricity		3.000	3.000	1	3.000	3.000
Shipping		0.600	0.600	1	0.600	0.600
Wage of laborers		4.200	4.200	1	4.200	4.200
Hybrid seeds		3.600	3.600	1	3.600	3.600
Plastic tubes for warm current of air		0.510	0.510	1	0.510	0.510
Supervisor for part-timers		2.000	2.000	1	2.000	2.000
Management cost		5.926	5.926	1	5.926	5.926
Other costs		1.489	1.489	1	1.489	1.489
Sum					<b>31.265</b>	<b>31.265</b>
<b>4 Balance</b>						
Total annual cash income (4 green hc		1,350	1,350	40,000	54.000	54.000
Total annual running cost					31.265	31.265
Net income					<b>22.735</b>	<b>22.735</b>
Per house					5.68375	5.68375
<b>Per 20 houses</b>					<b>113.675</b>	<b>113.675</b>

**Table A9.3.29 Financial and Economic Evaluation**  
**Case of 10 % Decrease of Agricultural Products**

Financial Cost				Economic Cost			
Year	Cost	Benefit	Incremental Benefit	Year	Cost	Benefit	Incremental Benefit
1	14,009.1	-1,789.1	-15,798.3	1	13,693.0	-1,725.1	-15,418.0
2	8,172.5	-87.3	-8,259.9	2	7,833.6	74.5	-7,759.1
3	8,847.6	96.8	-8,750.8	3	8,489.8	892.5	-7,597.4
4	17,556.5	1,518.9	-16,037.6	4	17,538.7	2,478.7	-15,060.1
5	1,352.8	4,947.6	3,594.9	5	1,325.1	6,231.0	4,905.9
6	292.5	6,305.5	6,013.0	6	292.5	6,687.6	6,395.1
7	10,726.5	6,305.5	-4,421.0	7	10,726.5	6,687.6	-4,038.9
8	292.5	9,432.4	9,139.8	8	292.5	10,052.5	9,759.9
9	292.5	9,432.4	9,139.8	9	292.5	10,052.5	9,759.9
10	292.5	9,432.4	9,139.8	10	292.5	10,052.5	9,759.9
11	2,449.6	9,432.4	6,982.7	11	2,459.1	10,052.5	7,593.4
12	481.7	9,432.4	8,950.6	12	483.6	10,052.5	9,568.8
13	671.6	9,432.4	8,760.7	13	675.4	10,052.5	9,377.0
14	481.7	9,432.4	8,950.6	14	483.6	10,052.5	9,568.8
15	671.6	9,432.4	8,760.7	15	675.4	10,052.5	9,377.0
16	291.8	9,432.4	9,140.5	16	291.8	10,052.5	9,760.6
17	291.8	9,432.4	9,140.5	17	291.8	10,052.5	9,760.6
18	291.8	9,432.4	9,140.5	18	291.8	10,052.5	9,760.6
19	291.8	9,432.4	9,140.5	19	291.8	10,052.5	9,760.6
20	291.8	9,432.4	9,140.5	20	291.8	10,052.5	9,760.6
21	4,033.4	9,432.4	5,398.9	21	4,042.9	10,052.5	6,009.6
22	481.7	9,432.4	8,950.6	22	483.6	10,052.5	9,568.8
23	671.6	9,432.4	8,760.7	23	675.4	10,052.5	9,377.0
24	481.7	9,432.4	8,950.6	24	483.6	10,052.5	9,568.8
25	671.6	9,432.4	8,760.7	25	675.4	10,052.5	9,377.0
26	7,708.4	9,432.4	1,724.0	26	7,382.7	10,052.5	2,669.7
27	8,061.4	9,432.4	1,370.9	27	7,720.6	10,052.5	2,331.9
28	8,534.7	9,432.4	897.6	28	8,173.2	10,052.5	1,879.3
29	731.8	9,432.4	8,700.5	29	712.2	10,052.5	9,340.3
30	1,004.4	9,432.4	8,427.9	30	972.9	10,052.5	9,079.5
	100,431.8	234,242.0			98,336.0	254,258.7	

IRR= 10.7%  
 NPV= -4,540.6  
 B/C= 2.3

IRR= 12.3%  
 NPV= 4,712.6  
 B/C= 2.6



**Table A9.3.30 Benefit of Agriculture in Financial Cost  
Case of 10 % Decrease of Agricultural Products**

		With Project (Million Riials)					Without				
Year		Crops		G. House	Cow		Total	Project	Balance		
		Area	per ha	Total	20 houses	per farmer	Farmer			Total	Amount
1	2004	1,000.00	1.151	1,151.375		0.000		1,151.4	2,940.508	(1,789.1)	
2	2005	1,400.00	1.280	1,791.475	113.675	16.632	57	948.024	2,853.2	2,940.508	(87.3)
3	2006	1,646.00	1.200	1,975.612	113.675	16.632	57	948.024	3,037.3	2,940.508	96.8
4	2007	2,014.00	1.687	3,397.694	113.675	16.632	57	948.024	4,459.4	2,940.508	1,518.9
5	2008	2,382.00	2.014	4,797.348	113.675	16.632	179	2,977.128	7,888.2	2,940.508	4,947.6
6	2009	3,040.00	2.025	6,155.240	113.675	16.632	179	2,977.128	9,246.0	2,940.508	6,305.5
7	2010	3,040.00	2.025	6,155.240	113.675	16.632	179	2,977.128	9,246.0	2,940.508	6,305.5
8	2011	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
9	2012	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
10	2013	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
11	2014	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
12	2015	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
13	2016	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
14	2017	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
15	2018	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
16	2019	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
17	2020	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
18	2021	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
19	2022	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
20	2023	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
21	2024	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
22	2025	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
23	2026	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
24	2027	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
25	2028	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
26	2029	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
27	2030	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
28	2031	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
29	2032	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4
30	2033	3,040.00	2.025	6,155.240	113.675	16.632	367	6,103.944	12,372.9	2,940.508	9,432.4

**Table A9.3.31 Benefit of Agriculture in Economic Cost  
Case of 10 % Decrease of Agricultural Products**

Year	With Project (Million Rials)						Without		Balance		
	Area	Crops per ha	Total	G. House 20 houses	per farmer	Cow Farmer	Total	Total Amount		Project	
1	2004	1,000.00	1.215	1,215.425		0.000		1,215.4	2,940.508	(1,725.1)	
2	2005	1,400.00	1.344	1,881.145	113.675	17.898	57	1,020.186	3,015.0	2,940.508	74.5
3	2006	1,646.00	1.640	2,699.119	113.675	17.898	57	1,020.186	3,833.0	2,940.508	892.5
4	2007	2,014.00	2.128	4,285.314	113.675	17.898	57	1,020.186	5,419.2	2,940.508	2,478.7
5	2008	2,382.00	2.458	5,854.122	113.675	17.898	179	3,203.742	9,171.5	2,940.508	6,231.0
6	2009	3,040.00	2.076	6,310.736	113.675	17.898	179	3,203.742	9,628.2	2,940.508	6,687.6
7	2010	3,040.00	2.076	6,310.736	113.675	17.898	179	3,203.742	9,628.2	2,940.508	6,687.6
8	2011	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
9	2012	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
10	2013	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
11	2014	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
12	2015	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
13	2016	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
14	2017	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
15	2018	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
16	2019	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
17	2020	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
18	2021	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
19	2022	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
20	2023	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
21	2024	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
22	2025	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
23	2026	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
24	2027	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
25	2028	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
26	2029	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
27	2030	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
28	2031	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
29	2032	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5
30	2033	3,040.00	2.076	6,310.736	113.675	17.898	367	6,568.566	12,993.0	2,940.508	10,052.5

**Table A9.3.32 Benefit of Agriculture in Initial Stage**  
**Case of 10 % Decrease of Agricultural Products**

	Year	Wheat		Rape		Grass		Pea		Cotton		Total net income			
		Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	per 4ha		per ha	
												Financial	Economic	Financial	Economic
Yield	1	2.7	2.7	1.8	1.8	0.0	0.0	0.0	0.0	1.2	1.2				
	2	2.7	2.7	1.8	1.8	0.0	0.0	0.0	0.0	1.4	1.4				
	3	3.0	3.0	2.0	2.0	2.7	2.7	0.9	0.9	1.4	1.4				
	4	3.2	3.2	2.2	2.2	3.2	3.2	1.2	1.2	1.6	1.6				
	5	3.6	3.6	2.3	2.3	3.6	3.6	1.4	1.4	1.6	1.6				
Producer Unit Price(Rial		1,050.0	1,076.0	2,050.0	2,050.0	825.0	825.0	1,870.0	1,870.0	2,850.0	2,850.0				
Gross Income (MillionRials)	1	2.835	2.905	3.690	3.690	0.000	0.000	0.000	0.000	3.335	3.335	9.860	9.930		
	2	2.835	2.905	3.690	3.690	0.000	0.000	0.000	0.000	3.848	3.848	10.373	10.443		
	3	3.119	3.196	4.059	4.059	2.228	2.228	1.683	1.683	4.104	4.104	15.192	15.269		
	4	3.308	3.389	4.428	4.428	2.599	2.599	2.188	2.188	4.617	4.617	17.139	17.221		
	5	3.780	3.874	4.613	4.613	2.970	2.970	2.525	2.525	4.560	4.560	18.447	18.541		
Production Cost Million Rials	1	1.110	0.999	1.214	1.139	0.000	0.000	0.000	0.000	2.930	2.930	5.254	5.068		
	2	1.110	0.999	1.214	1.139	0.000	0.000	0.000	0.000	2.930	2.930	5.254	5.068		
	3	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
	4	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
	5	1.110	0.999	1.214	1.139	1.365	1.064	1.789	1.488	4.913	4.020	10.391	8.710		
Net Income Million Rials	1	1.725	1.906	2.476	2.551	0.000	0.000	0.000	0.000	0.405	0.405	4.606	4.862	1.151	1.215
	2	1.725	1.906	2.476	2.551	0.000	0.000	0.000	0.000	0.918	0.918	5.119	5.375	1.280	1.344
	3	2.009	2.197	2.845	2.920	0.863	1.164	(0.106)	0.195	(0.809)	0.084	4.801	6.559	1.200	1.640
	4	2.198	2.390	3.214	3.289	1.234	1.535	0.399	0.700	(0.296)	0.597	6.748	8.511	1.687	2.128
	5	2.670	2.875	3.399	3.474	1.605	1.906	0.736	1.037	(0.353)	0.540	8.056	9.831	2.014	2.458

**Table A9.3.33 Benefit of Agriculture**  
**Case of 10 % Decrease of Agricultural Products**

(5 crops cultivation under irrigation in 4-years rotation and raising of hybrid local cows of 10 heads)

Item	Yield kg/ha	Producers' unit price		Gross income		Production cost		Net income	
		Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic
		Rls./kg	Million Rls./ha	Million Rls./ha	Million Rls./ha	Million Rls./ha	Million Rls./ha	Million Rls./ha	Million Rls./ha
Crops introduced to the plan									
Wheat	3,600	1,050	1,076	3.780	3.874	1.110	0.999	2.670	2.874
Rape	2,250	2,050	2,050	4.613	4.613	1.214	1.139	3.399	3.474
Grass (hay)	3,600	825	825	2.970	2.970	1.365	1.064	1.605	1.906
Pea	1,350	1,870	1,870	2.525	2.525	1.789	1.488	0.736	1.037
Cotton	1,800	2,850	2,850	5.130	5.130	4.913	4.020	0.217	1.110
Total annual net income of 4 ha in four-year crop rotation								8.626	10.400
Net income for 1ha								2.156	2.600
Animal husbandry Raising of hybrid cows of 10 head				49.120		24.596		24.524	
Total annual net income								33.150	

**2. Without Project**

Due to the tendency of the unit yield per hectare is declined in the area, the present productivity condition will continue in the case of without project

Crop	Area	yield	Gross Income	Production Cost	Net
	ha	t	Million Rls	Million Rls	Million Rls
Wheat	1,200	2.54	3,201.7	1.07	1,917.66
Rape	80	2.00	328.0	1.00	248.00
Grass	0				0.00
Pea	0				0.00
Cotton	70	1.70	339.9	2.93	134.85
Barley	800	2.00	1,312.0	0.84	640.00
Total	2,150		5,181.6		2,940.51

**Table A9.3.34 Benefit of Hybrid Cow  
Case of 10 % Decrease of Agricultural Products**

No.	Items	Unit price		Quantity	Amount	
		Financial Rls	Economic		Financial m2 Million Rls.	Economic
1	Investment					
	1) Buildings					
	Mother cow stall	170,000	170,000	40	6.800	6.800
	Female cow (2 years old) stall	170,000	170,000	10	1.700	1.700
	Cow (1 year old) stall	170,000	170,000	10	1.700	1.700
	Calves stall	230,000	230,000	8	1.840	1.840
	Storage room of concentrate f	250,000	250,000	12	3.000	3.000
	Paddock	43,000	43,000	80	3.440	3.440
	Feeder	924,000	924,000	1	0.924	0.924
	<b>Sum</b>				<b>19.404</b>	<b>19.404</b>
	2) Facilities			unit		
	Milker	3,000,000	3,000,000	1	3.000	3.000
	Sterilizer	3,500,000	3,500,000	1	3.500	3.500
	Milk-storage tank	500,000	500,000	1	0.500	0.500
	Others	350,000	350,000	1	0.350	0.350
	<b>Sum</b>				<b>7.350</b>	<b>7.350</b>
	<b>Total of Building and Equip</b>				<b>26.754</b>	<b>26.754</b>
	3) Purchase of 10 heads cows	5,500,000	5,500,000	10	55.000	<b>55.000</b>
	<b>Total</b>				<b>81.754</b>	<b>81.754</b>
2	Annual running cost					
	Medicines, sanitary goods, va	1,250,000	1,250,000	1	1.250	1.250
	Charges of water and electrici	500,000	500,000	1	0.500	0.500
	Fuel charge	500,000	500,000	1	0.500	0.500
	Concentrate feed   kg	860	860	15,000	12.900	12.900
	Hay                   kg	300	300	25,000	7.500	7.500
	Others	680,000	680,000	1	0.680	0.680
	<b>Sum</b>				<b>23.330</b>	<b>23.330</b>
3	Annual total cost					
	Depreciation of building	776,000	0	1	0.776	0.000
	Depreciation of facilities	490,000	0	1	0.490	0.000
	Running cost	23,330,000	23,330,000	1	23.330	23.330
	<b>Sum</b>				<b>24.596</b>	<b>23.330</b>
4	Annual gross income					
	Sale of milk	1,490	1,490	16,200	24.138	24.138
	Sale of bull (1 year old)	2,500,000	2,500,000	4	9.000	9.000
	Sale of cow (over 2 years old)	3,000,000	3,000,000	4	10.800	10.800
	Sale of manure (ton)	15,000	15,000	18	0.270	0.270
	<b>Sum</b>				<b>44.208</b>	<b>44.208</b>
5	Balance				<b>19.612</b>	<b>20.878</b>

**A Existing Condition of Cow breeding**

There is no available data of the actual numbers of cows in the area, the estimation is made as following manner;

Based on the results of the hearing, half to the farmers of the area have two to ten cows.

If half of the 375 framers in the cad aster have 5 cows, 940 cows ( 375/2 x 5=938) are bre

The milk production of each cow is annually 800 litter, and the sales price per litter is

Thus, the benefit of the each farmer in the present condition is as follows;

$$800 \times 1,490 \times 5 = 5.96 \text{ Million rials/farmer}$$

B Cow introduction schedule

Year	Nos. of Farmers			
1	57	farmers (land tenure over 10ha) 16%		
2				
3				
4	122	farmers (land tenure between 5ha to 10ha) 33%		
5				
6				
7	188	farmers (land tenure less than 5ha) 51%		

C The milk production will start one year after of the introduction of cows, and the increment benefit between present condition and with project is ;

Half of farmer will change traditional variety to Hybrid cow.

Therefore, net income is calculated as following manner.

Financial in Million Rials  $\{19.612+(19.612-5.96)\}/2=16.632$

Economic in Million Rials  $\{20.878+(20.878-5.96)\}/2=17.898$

**Benefit Increment**

Year	Increment Benefit				
	Unit amount		Quantity	Amount	
	Financial	Economic		Financial	Economic
1	0	0	0	0.000	0.000
2	16.632	17.898	57	948.024	1,020.186
3	16.632	17.898	57	948.024	1,020.186
4	16.632	17.898	57	948.024	1,020.186
5	16.632	17.898	179	2,977.128	3,203.742
6	16.632	17.898	179	2,977.128	3,203.742
7	16.632	17.898	179	2,977.128	3,203.742
8	16.632	17.898	367	6,103.944	6,568.566
9	16.632	17.898	367	6,103.944	6,568.566

**Table A9.3.35 Benefit of Plastic Green House**  
**Case of 10 % Decrease of Agricultural Products**

No. Items	Unit price		Quantity	Amount		
	Financial Rls	Economic		Financial Million Rls.	Economic	
<b>1 Investment</b>						
1) Construction and facilities of green house						
Frame pipe	4x500m2	25,000	25,000	2000	50.000	50.000
Heater		5,000,000	5,000,000	4	20.000	20.000
Ventilator		400,000	400,000	8	3.200	3.200
Irrigation facilities	m2	7,500	7,500	2,000	15.000	15.000
water tank		2,000,000	2,000,000	1	2.000	2.000
Plastic film	m2	1,000	1,000	5,000	5.000	5.000
Generator		5,000,000	5,000,000	1	5.000	5.000
Guard and resting house		5,400,000	5,400,000	1	5.400	5.400
Others		5,288,000	5,288,000	1	5.288	5.288
Sum					<b>110.888</b>	110.888
2) Equipments and implements						
Sprayer		3,000,000	3,000,000	1	3.000	3.000
Thermometer		70,000	70,000	4	0.280	0.280
Thermometer in soil		100,000	100,000	4	0.400	0.400
Hygrometer		7,000	7,000	4	0.028	0.028
Scissors with long grips		80,000	80,000	4	0.320	0.320
Scissors with short grips		20,000	20,000	4	0.080	0.080
Ordinary scissors		75,000	75,000	4	0.300	0.300
Hoe		20,000	20,000	4	0.080	0.080
Trowel		4,000	4,000	10	0.040	0.040
Handcart		150,000	150,000	2	0.300	0.300
Lighting facilities		2,000,000	2,000,000	1	2.000	2.000
Rake		7,000	7,000	4	0.028	0.028
Thermostat		40,000	40,000	4	0.160	0.160
Others		363,000	363,000	1	0.363	0.363
Sum					<b>7.379</b>	<b>7.379</b>
<b>Grand Total</b>					<b>118.267</b>	<b>118.267</b>
<b>Investment cost per 1 unit (500m2)</b>					<b>29.567</b>	<b>29.567</b>
<b>3 Running cost (2 times cultivation during a year)</b>						
Liquid fertilizer		0.400	0.400	1	0.400	0.400
Chemical fertilizer		0.200	0.200	1	0.200	0.200
Manure		0.200	0.200	1	0.200	0.200
String		0.240	0.240	1	0.240	0.240
Chemicals		0.500	0.500	1	0.500	0.500
Packing materials		3.000	3.000	1	3.000	3.000
Fuel		5.400	5.400	1	5.400	5.400
Electricity		3.000	3.000	1	3.000	3.000
Shipping		0.600	0.600	1	0.600	0.600
Wage of laborers		4.200	4.200	1	4.200	4.200
Hybrid seeds		3.600	3.600	1	3.600	3.600
Plastic tubes for warm current of air		0.510	0.510	1	0.510	0.510
Supervisor for part-timers		2.000	2.000	1	2.000	2.000
Management cost		5.926	5.926	1	5.926	5.926
Other costs		1.489	1.489	1	1.489	1.489
Sum					<b>31.265</b>	<b>31.265</b>
<b>4 Balance</b>						
Total annual cash income (4 green ho		1,500	1,500	36,000	54.000	54.000
Total annual running cost					31.265	31.265
Net income					<b>22.735</b>	<b>22.735</b>
Per house					4.547	4.547
<b>Per 20 houses</b>					<b>113.675</b>	<b>113.675</b>

**Table A9.3.36 Share of Construction cost by Government and Farmers**

unit : million rials

	Description	Total	Govt	Farmer
1	Construction Works	21,341.6	15,973.7	5,367.9
	Procurement of O/M Equipment	0.0	0.0	0.0
2	Administration	312.0	0.0	312.0
3	Consulting Services	225.9	0.0	225.9
	Sub-total (1-3)	21,879.5	15,973.7	5,905.8
4	Physical Contingency (7%)	1,531.6	1,118.2	413.4
	Sub-total (1-4)	23,411.1	17,091.9	6,319.2
5	Economic Contingency ( 5 %)	1,170.6	854.6	316.0
	Total (1-5)	24,581.6	17,946.5	6,635.1
	Share		73.0%	27.0%

## Project Cost shared by Farmers

unit : million rials

	Description	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
1	Construction Works	6,434.6	6,814.7	7,236.0	303.6	552.7	21,341.6
2	Administration	62.4	62.4	62.4	62.4	62.4	312.0
3	Consulting Services	104.3	38.4	38.4	25.6	19.2	225.9
	Sub-total (1-3)	6,601.3	6,915.5	7,336.8	391.6	634.3	21,879.5
4	Physical Contingency (7%)	462.1	484.1	513.6	27.4	44.4	1,531.6
	Sub-total (1-4)	7,063.4	7,399.6	7,850.4	419.0	678.7	23,411.1
5	Economic Contingency ( 5 %)	353.2	370.0	392.5	21.0	33.9	1,170.6
	Total (1-5)	7,416.6	7,769.6	8,242.9	440.0	712.6	24,581.7
	Annual Farmer Debt (27%)	2,001.9	2,097.2	2,224.9	118.8	192.3	6,635.1
	Annual Progress	30.2%	31.6%	33.5%	1.8%	2.9%	100.0%



**Table A9.3.37 Cash Flow : Crop cultivation through Irrigation and Drainage Improvement**  
**In case of repayment period is 5 years**

Year	Investment			Capital Repayment					Balance	Interest Payment	Annual Payment	Farmer's Benefit	Total Balance	
	I & D	Machinery	Total					Total						
1	2,001.9	949.5	2,951.4					0.0	2,951.4	413.2	3,364.6	1,425.3	-1,939.3	
2	2,097.2	189.9	2,287.1	590.3				590.3	4,648.2	650.8	5,299.0	2,194.9	-3,104.1	
3	2,224.9	379.8	2,604.7	590.3	457.4			1,047.7	6,205.2	868.7	7,074.0	2,670.2	-4,403.7	
4	118.8	189.9	308.7	590.3	457.4	520.9		1,568.6	4,945.3	692.3	5,637.6	4,356.5	-1,281.1	
5	192.3	379.8	572.1	590.3	457.4	520.9	61.7	1,630.4	3,887.0	544.2	4,431.2	6,395.1	1,963.9	
6		0.0	0.0	590.3	457.4	520.9	61.7	114.4	1,744.8	2,142.2	299.9	2,442.1	8,161.6	5,719.5
7		0.0	0.0		457.4	520.9	61.7	114.4	1,154.5	987.7	138.3	1,126.0	8,161.6	7,035.7
8		0.0	0.0			520.9	61.7	114.4	697.1	290.6	40.7	331.3	8,161.6	7,830.4
9		0.0	0.0				61.7	114.4	176.2	114.4	16.0	130.4	8,161.6	8,031.2
10		0.0	0.0					114.4	114.4	0.0	0.0	0.0	8,161.6	8,161.6
11		949.5	949.5						0.0	949.5	132.9	1,082.4	8,161.6	7,079.2
12		189.9	189.9	189.9					189.9	949.5	132.9	1,082.4	8,161.6	7,079.2
13		379.8	379.8	189.9	38.0				227.9	1,101.4	154.2	1,255.6	8,161.6	6,906.0
14		189.9	189.9	189.9	38.0	76.0			303.8	987.5	138.2	1,125.7	8,161.6	7,035.9
15		379.8	379.8	189.9	38.0	76.0	38.0		341.8	1,025.5	143.6	1,169.0	8,161.6	6,992.6
16		0.0	0.0	189.9	38.0	76.0	38.0	76.0	417.8	607.7	85.1	692.8	8,161.6	7,468.9
17		0.0	0.0		38.0	76.0	38.0	76.0	227.9	379.8	53.2	433.0	8,161.6	7,728.7
18		0.0	0.0			76.0	38.0	76.0	189.9	189.9	26.6	216.5	8,161.6	7,945.2
19		0.0	0.0				38.0	76.0	113.9	76.0	10.6	86.6	8,161.6	8,075.0
20		0.0	0.0					76.0	76.0	0.0	0.0	0.0	8,161.6	8,161.6
21		949.5	949.5						0.0	949.5	132.9	1,082.4	8,161.6	7,079.2
22		189.9	189.9	189.9					189.9	949.5	132.9	1,082.4	8,161.6	7,079.2
23		379.8	379.8	189.9	38.0				227.9	1,101.4	154.2	1,255.6	8,161.6	6,906.0
24		189.9	189.9	189.9	38.0	76.0			303.8	987.5	138.2	1,125.7	8,161.6	7,035.9
25		379.8	379.8	189.9	38.0	76.0	38.0		341.8	1,025.5	143.6	1,169.0	8,161.6	6,992.6
26		0.0	0.0	189.9	38.0	76.0	38.0	76.0	417.8	607.7	85.1	692.8	8,161.6	7,468.9
27		0.0	0.0		38.0	76.0	38.0	76.0	227.9	379.8	53.2	433.0	8,161.6	7,728.7
28		0.0	0.0			76.0	38.0	76.0	189.9	189.9	26.6	216.5	8,161.6	7,945.2
29		0.0	0.0				38.0	76.0	113.9	76.0	10.6	86.6	8,161.6	8,075.0
30		0.0	0.0					76.0	76.0	0.0	0.0	0.0	8,161.6	8,161.6

**Table A9.3.38 Cash Flow : Crop cultivation through Irrigation and Drainage Improvement**  
**In case of repayment period of I&D cost is 10 years**

Year	Investment			Capital Repayment						Balance	Interest Payment	Annual Payment	Farmer's Benefit	Total Balance
	I & D	Machinery	Total						Total					
1	2,001.9	949.5	2,951.4						0.0	2,951.4	413.2	3,364.6	1,425.3	-1,939.3
2	2,097.2	189.9	2,287.1	390.1					390.1	4,848.4	678.8	5,527.2	2,194.9	-3,332.3
3	2,224.9	379.8	2,604.7	390.1	247.7				637.8	6,815.3	954.1	7,769.5	2,670.2	-5,099.2
4	118.8	189.9	308.7	390.1	247.7	298.5			936.2	6,187.8	866.3	7,054.1	4,356.5	-2,697.5
5	192.3	379.8	572.1	390.1	247.7	298.5	49.9		986.1	5,773.8	808.3	6,582.1	6,395.1	-187.0
6		0.0	0.0	390.1	247.7	298.5	49.9	95.2	1,081.3	4,692.5	656.9	5,349.4	8,161.6	2,812.2
7		0.0	0.0	200.2	247.7	298.5	49.9	95.2	891.4	3,801.1	532.2	4,333.3	8,161.6	3,828.4
8		0.0	0.0	200.2	209.7	298.5	49.9	95.2	853.4	2,947.7	412.7	3,360.4	8,161.6	4,801.3
9		0.0	0.0	200.2	209.7	222.5	49.9	95.2	777.5	2,170.2	303.8	2,474.1	8,161.6	5,687.6
10		0.0	0.0	200.2	209.7	222.5	11.9	95.2	739.5	1,430.8	200.3	1,631.1	8,161.6	6,530.6
11		949.5	949.5	200.2	209.7	222.5	11.9	19.2	663.5	1,716.8	240.3	1,957.1	8,161.6	6,204.5
12		189.9	189.9	189.9	209.7	222.5	11.9	19.2	653.2	1,253.4	175.5	1,428.9	8,161.6	6,732.7
13		379.8	379.8	189.9	38.0	222.5	11.9	19.2	481.5	1,151.8	161.2	1,313.0	8,161.6	6,848.6
14		189.9	189.9	189.9	38.0	76.0	11.9	19.2	335.0	1,006.7	140.9	1,147.6	8,161.6	7,014.0
15		379.8	379.8	189.9	38.0	76.0	38.0	19.2	361.1	1,025.5	143.6	1,169.0	8,161.6	6,992.6
16		0.0	0.0	189.9	38.0	76.0	38.0	76.0	417.8	607.7	85.1	692.8	8,161.6	7,468.9
17		0.0	0.0		38.0	76.0	38.0	76.0	227.9	379.8	53.2	433.0	8,161.6	7,728.7
18		0.0	0.0			76.0	38.0	76.0	189.9	189.9	26.6	216.5	8,161.6	7,945.2
19		0.0	0.0				38.0	76.0	113.9	76.0	10.6	86.6	8,161.6	8,075.0
20		0.0	0.0					76.0	76.0	0.0	0.0	0.0	8,161.6	8,161.6
21		949.5	949.5						0.0	949.5	132.9	1,082.4	8,161.6	7,079.2
22		189.9	189.9	189.9					189.9	949.5	132.9	1,082.4	8,161.6	7,079.2
23		379.8	379.8	189.9	38.0				227.9	1,101.4	154.2	1,255.6	8,161.6	6,906.0
24		189.9	189.9	189.9	38.0	76.0			303.8	987.5	138.2	1,125.7	8,161.6	7,035.9
25		379.8	379.8	189.9	38.0	76.0	38.0		341.8	1,025.5	143.6	1,169.0	8,161.6	6,992.6
26		0.0	0.0	189.9	38.0	76.0	38.0	76.0	417.8	607.7	85.1	692.8	8,161.6	7,468.9
27		0.0	0.0		38.0	76.0	38.0	76.0	227.9	379.8	53.2	433.0	8,161.6	7,728.7
28		0.0	0.0			76.0	38.0	76.0	189.9	189.9	26.6	216.5	8,161.6	7,945.2
29		0.0	0.0				38.0	76.0	113.9	76.0	10.6	86.6	8,161.6	8,075.0
30		0.0	0.0					76.0	76.0	0.0	0.0	0.0	8,161.6	8,161.6

**Table A9.3.39 Cash flow : Green House, 20 houses**

Year	Investment G. House	Capital repayment	Total Repayment	Balance	Interest Payment	Annual Payment	Farmer's Benefit	Total Balance
1	591.3		0.0	591.3	82.8	82.8	0.0	-82.8
2	0.0	118.3	118.3	473.1	66.2	184.5	143.7	-40.8
3	0.0	118.3	118.3	354.8	49.7	167.9	143.7	-24.3
4	0.0	118.3	118.3	236.5	33.1	151.4	143.7	-7.7
5	0.0	118.3	118.3	118.3	16.6	134.8	143.7	8.9
6	0.0	118.3	118.3	0.0	0.0	118.3	143.7	25.4
7	0.0		0.0	0.0	0.0	0.0	143.7	143.7
8	0.0		0.0	0.0	0.0	0.0	143.7	143.7
9	0.0		0.0	0.0	0.0	0.0	143.7	143.7
10	0.0		0.0	0.0	0.0	0.0	143.7	143.7
11	591.3		0.0	591.3	82.8	82.8	143.7	60.9
12	0.0		0.0	591.3	82.8	82.8	143.7	60.9
13	0.0	118.3	118.3	473.1	66.2	184.5	143.7	-40.8
14	0.0	118.3	118.3	354.8	49.7	167.9	143.7	-24.3
15	0.0	118.3	118.3	236.5	33.1	151.4	143.7	-7.7
16	0.0	118.3	118.3	118.3	16.6	134.8	143.7	8.9
17	0.0	118.3	118.3	0.0	0.0	118.3	143.7	25.4
18	0.0		0.0		0.0	0.0	143.7	143.7
19	0.0		0.0		0.0	0.0	143.7	143.7
20	0.0		0.0		0.0	0.0	143.7	143.7
21	591.3		0.0	591.3	82.8	82.8	143.7	60.9
22	0.0	118.3	118.3	473.1	66.2	184.5	143.7	-40.8
23	0.0	118.3	118.3	354.8	49.7	167.9	143.7	-24.3
24	0.0	118.3	118.3	236.5	33.1	151.4	143.7	-7.7
25	0.0	118.3	118.3	118.3	16.6	134.8	143.7	8.9
26	0.0	118.3	118.3	0.0		118.3	143.7	25.4
27	0.0			0.0		0.0	143.7	143.7
28	0.0			0.0		0.0	143.7	143.7
29	0.0			0.0		0.0	143.7	143.7
30	0.0					0.0	143.7	143.7

**Table A9.3.40 Cash Flow : Hybrid Cow for One Farmer**

Year	Investment			Capital repayment	Total Repayment	Balance	Interest Payment	Annual Payment	Farmer's Benefit	Total Balance
	Cow	Equip.	Total							
1	55.0	26.8	81.8			81.8	11.4	11.4	0.0	-11.4
2	0.0		0.0	16.4	16.4	65.4	9.2	25.5	24.5	-1.0
3	0.0		0.0	16.4	16.4	49.1	6.9	23.2	24.5	1.3
4	0.0		0.0	16.4	16.4	32.7	4.6	20.9	24.5	3.6
5	0.0		0.0	16.4	16.4	16.4	2.3	18.6	24.5	5.9
6	0.0		0.0	16.4	16.4	0.0	0.0	16.4	24.5	8.1
7	0.0		0.0		0.0	0.0	0.0	0.0	24.5	24.5
8	0.0		0.0		0.0	0.0	0.0	0.0	24.5	24.5
9	0.0		0.0		0.0	0.0	0.0	0.0	24.5	24.5
10	0.0		0.0		0.0	0.0	0.0	0.0	24.5	24.5
11	0.0	7.4	7.4		0.0	7.4	1.0	1.0	24.5	23.5
12	0.0		0.0	1.5	1.5	5.9	0.8	2.3	24.5	22.2
13	0.0		0.0	1.5	1.5	4.4	0.6	2.1	24.5	22.4
14	0.0		0.0	1.5	1.5	3.0	0.4	1.9	24.5	22.6
15	0.0		0.0	1.5	1.5	1.5	0.2	1.7	24.5	22.8
16	0.0		0.0	1.5	1.5	0.0	0.0	1.5	24.5	23.0
17	0.0		0.0		0.0	0.0	0.0	0.0	24.5	24.5
18	0.0		0.0		0.0		0.0	0.0	24.5	24.5
19	0.0		0.0		0.0		0.0	0.0	24.5	24.5
20	0.0		0.0		0.0		0.0	0.0	24.5	24.5
21	19.4	19.4	38.8		0.0	38.8	5.4	5.4	24.5	19.1
22	0.0		0.0	7.8	7.8	31.0	4.3	12.1	24.5	12.4
23	0.0		0.0	7.8	7.8	23.3	3.3	11.0	24.5	13.5
24	0.0		0.0	7.8	7.8	15.5	2.2	9.9	24.5	14.6
25	0.0		0.0	7.8	7.8	7.8	1.1	8.8	24.5	15.7
26	0.0		0.0	7.8	7.8	0.0			24.5	24.5
27	0.0		0.0			0.0			24.5	24.5
28	0.0		0.0			0.0			24.5	24.5
29	0.0		0.0			0.0			24.5	24.5
30	0.0		0.0						24.5	24.5

**Table A.9.3.41 Cash Flow : Hybrid Cow for All Farmers**

Year	Investment Cow	Capital Repayment				Balance	Interest Payment	Annual Payment	Farmer's Benefit	Total Balance
		Repayment 1	Repayment 2	Repayment 3	Total					
1	4,660.0				0.0	4,660.0	652.4	652.4	0.0	-652.4
2	0.0	932.0			932.0	3,728.0	521.9	1,453.9	1,397.9	-56.0
3	0.0	932.0			932.0	2,796.0	391.4	1,323.4	1,397.9	74.4
4	16,684.0	932.0			932.0	18,548.0	2,596.7	3,528.7	1,397.9	-2,130.8
5	0.0	932.0	3,336.8		4,268.8	14,279.2	1,999.1	6,267.9	4,389.8	-1,878.1
6	0.0	932.0	3,336.8		4,268.8	10,010.4	1,401.5	5,670.2	4,389.8	-1,280.5
7	10,434.0		3,336.8		3,336.8	17,107.6	2,395.1	5,731.9	4,389.8	-1,342.1
8	0.0		3,336.8	2,086.8	5,423.6	11,684.0	1,635.8	7,059.4	9,000.3	1,941.0
9	0.0		3,336.8	2,086.8	5,423.6	6,260.4	876.5	6,300.1	9,000.3	2,700.3
10	0.0			2,086.8	2,086.8	4,173.6	584.3	2,671.1	9,000.3	6,329.2
11	419.0			2,086.8	2,086.8	2,505.8	350.8	2,437.6	9,000.3	6,562.7
12	0.0			2,086.8	2,086.8	418.9	58.7	2,145.5	9,000.3	6,854.9
13	0.0	83.8			83.8	335.2	46.9	130.7	9,000.3	8,869.6
14	0.0	83.8			83.8	251.4	35.2	119.0	9,000.3	8,881.3
15	0.0	83.8			83.8	167.6	23.5	107.3	9,000.3	8,893.1
16	0.0	83.8			83.8	83.8	11.7	95.5	9,000.3	8,904.8
17	0.0	83.8			83.8	0.0	0.0	83.8	9,000.3	8,916.5
18	0.0				0.0		0.0	0.0	9,000.3	9,000.3
19	0.0				0.0		0.0	0.0	9,000.3	9,000.3
20	0.0				0.0		0.0	0.0	9,000.3	9,000.3
21	2,002.7				0.0	2,002.7	280.4	280.4	9,000.3	8,719.9
22	0.0	400.5			400.5	1,602.2	224.3	624.9	9,000.3	8,375.5
23	0.0	400.5			400.5	1,201.6	168.2	568.8	9,000.3	8,431.5
24	0.0	400.5			400.5	801.1	112.2	512.7	9,000.3	8,487.6
25	0.0	400.5			400.5	400.5	56.1	456.6	9,000.3	8,543.7
26	0.0	400.5			400.5	0.0			9,000.3	9,000.3
27	0.0					0.0			9,000.3	9,000.3
28	0.0					0.0			9,000.3	9,000.3
29	0.0					0.0			9,000.3	9,000.3
30	0.0								9,000.3	9,000.3

**Table A9.3.42 Cash flow : Full Scale Development**

Year	Investment				Capital repayment				Balance	Interest Payment	Annual Payment	Farmer's Benefit	Total Balance
	I & D	Cow	G. house	Total	I & D	Cow	G. house	Total					
1	2,951.4	4,660.0	591.3	8,202.7	0.0	0.0	0.0	0.0	8,202.7	1,148.4	9,351.1	1,425.3	-7,925.8
2	2,287.1	0.0	0.0	2,287.1	590.3	932.0	118.3	1,640.5	8,849.3	1,238.9	10,088.2	3,736.4	-6,351.8
3	2,604.7	0.0	0.0	2,604.7	1,047.7	932.0	118.3	2,098.0	9,356.0	1,309.8	10,665.8	4,211.8	-6,454.1
4	308.7	16,684.0	0.0	16,992.7	1,568.6	932.0	118.3	2,618.9	23,729.8	3,322.2	27,052.0	5,898.1	-21,153.9
5	572.1	0.0	0.0	572.1	1,630.4	4,268.8	118.3	6,017.4	18,284.5	2,559.8	20,844.3	10,928.5	-9,915.7
6	0.0	0.0	0.0	0.0	1,744.8	4,268.8	118.3	6,131.9	12,152.6	1,701.4	13,854.0	12,695.1	-1,158.8
7	0.0	10,434.0	0.0	10,434.0	1,154.5	3,336.8	0.0	4,491.3	18,095.3	2,533.3	20,628.6	12,695.1	-7,933.5
8	0.0	0.0	0.0	0.0	697.1	5,423.6	0.0	6,120.7	11,974.6	1,676.4	13,651.0	17,305.6	3,654.6
9	0.0	0.0	0.0	0.0	176.2	5,423.6	0.0	5,599.8	6,374.8	892.5	7,267.3	17,305.6	10,038.3
10	0.0	0.0	0.0	0.0	114.4	2,086.8	0.0	2,201.2	4,173.6	584.3	4,757.9	17,305.6	12,547.7
11	949.5	419.0	591.3	1,959.8	0.0	2,086.8	0.0	2,086.8	4,046.6	566.5	4,613.1	17,305.6	12,692.5
12	189.9	0.0	0.0	189.9	189.9	2,086.8	0.0	2,276.7	1,959.8	274.4	2,234.2	17,305.6	15,071.5
13	379.8	0.0	0.0	379.8	227.9	83.8	118.3	429.9	1,909.6	267.4	2,177.0	17,305.6	15,128.6
14	189.9	0.0	0.0	189.9	303.8	83.8	118.3	505.9	1,593.7	223.1	1,816.8	17,305.6	15,488.9
15	379.8	0.0	0.0	379.8	341.8	83.8	118.3	543.9	1,429.6	200.1	1,629.7	17,305.6	15,675.9
16	0.0	0.0	0.0	0.0	417.8	83.8	118.3	619.8	809.7	113.4	923.1	17,305.6	16,382.5
17	0.0	0.0	0.0	0.0	227.9	83.8	118.3	429.9	379.8	53.2	433.0	17,305.6	16,872.7
18	0.0	0.0	0.0	0.0	189.9	0.0	0.0	189.9	189.9	26.6	216.5	17,305.6	17,089.1
19	0.0	0.0	0.0	0.0	113.9	0.0	0.0	113.9	76.0	10.6	86.6	17,305.6	17,219.0
20	0.0	0.0	0.0	0.0	76.0	0.0	0.0	76.0	0.0	0.0	0.0	17,305.6	17,305.6
21	949.5	2,002.7	591.3	3,543.6	0.0	0.0	0.0	0.0	3,543.6	496.1	4,039.7	17,305.6	13,266.0
22	189.9	0.0	0.0	189.9	189.9	400.5	118.3	708.7	3,024.8	423.5	3,448.2	17,305.6	13,857.4
23	379.8	0.0	0.0	379.8	227.9	400.5	118.3	746.7	2,657.9	372.1	3,030.0	17,305.6	14,275.7
24	189.9	0.0	0.0	189.9	303.8	400.5	118.3	822.7	2,025.1	283.5	2,308.6	17,305.6	14,997.0
25	379.8	0.0	0.0	379.8	341.8	400.5	118.3	860.6	1,544.3	216.2	1,760.5	17,305.6	15,545.2
26	0.0	0.0	0.0	0.0	417.8	400.5	118.3	936.6	607.7	85.1	692.8	17,305.6	16,612.9
27	0.0	0.0	0.0	0.0	227.9	0.0	0.0	227.9	379.8	53.2	433.0	17,305.6	16,872.7
28	0.0	0.0	0.0	0.0	189.9	0.0	0.0	189.9	189.9	26.6	216.5	17,305.6	17,089.1
29	0.0	0.0	0.0	0.0	113.9	0.0	0.0	113.9	76.0	10.6	86.6	17,305.6	17,219.0
30	0.0	0.0	0.0	0.0	76.0	0.0	0.0	76.0	0.0	0.0	0.0	17,305.6	17,305.6